





### Still Better

#### New Crosley Radio Receivers

THAT Crosley Radio Receivers have given complete satisfaction in the past is evidenced by the fact that, during the last twelve months, The Crosley Radio Corporation produced more receiving sets than any manufacturer in the world. That the new line of Crosley instruments, illustrated herewith, will give even better service is assured by the exhaustive tests to which each model has been subjected both in our laboratories and in actual use under all weather conditions. Each Crosley Model is designed to give the utmost efficiency at the lowest cost.

Before you purchase a radio receiver listen in on a Crosley. Compare its performance with any other instrument on the market. We know then that you will choose a Crosley.



Crosley \$1, \$18.60



Crusley 51-P, \$25.00





See the Crosley line at your dealers

 CROSLEY 51-P-This is our new portable set. It is the Crosley Model 51 two tube receiver mounted in a leather-ette covered carrying case, battery space and all self-contained Price \$25.00

CROSLEY TRIRDYN 3R3—This three tube receiver gives the efficiency and volume of many five tube sets. We believe it is the most efficient receiver on the market at any price for bringing in long distance stations... Price \$68.00

#### THE CROSLEY RADIO CORPORATION

Powel Crosley, Jr., President

917 Alfred Street

Cincinnati, Ohio

#### CROSLEY

All Crosley Regimentive Receivers licensed Better under Armstrong U. S. Patent, 1,113,149 Radio

Better-Cost Less Radio Products

The Crusley Radio Corpor tion owns and operates broadcasting it tion WLW

## Popular Science Monthly

Most Wonderfully Illustrated Magazine in the World

SEPTEMBER, 1924; Vol. 105, No. 3 25 cents a Copy; \$2.50 a Year



Published in New York City at 250 Fourth Avenue

### Coming Next Month

How to light your home scientifically. Did you know that color, like music, has the power to stimulate or depress you, to make you gay or sad, to disturb or refresh you? In an extraordinary article in next month's Popular Science Monthly, a lighting expert reveals astonishing facts about light and color and their important effects on your health, comfort, and happiness.

Are there twins in your family, or among your acquaintances? If so, you will be interested in an article by Dr. H. H. Newman, Professor of Zoology and Embryology at the University of Chicago. From scientific research, he explains in plain words the mysteries of multiple birth that have puzzled and fascinated men and women for centuries. One of the most enlightening discussions of the subject ever published.

This is the day of the mechanical housemaid. What the efficiency engineer is doing for the factory, you can do for your new home while it is under construction by building in the mechanical conveniences that mean a permanent saving of time, labor, and drudgery. In next month's issue an expert will tell how to do it.

What are minerals? Perhaps you think of them only as ores and precious metals. But did you know that minerals probably are the most important things in the world to you-that they go into the food you eat, the very bones of your body, the buildings you live and work in—in fact, that they make possible all the wonders of modern industry and transportation. The scientific facts that Raymond J. Brown tells about them in another of his fascinating articles next month will truly amaze you.

The last word in radio is contained in POPULAR SCIENCE MONTHLY'S enlarged Radio Section, the best and most useful of its kind published in any magazine. Here, every month, you will find the important news of radio progress in all its phases, practical construction articles, and useful hints for everybody—all in simple, non-technical English.

Thomas Wilfred, must class and inventor, at the buyboard of the organ with which he plays pleasing symphonies of light on a acreeb, just as a music cian would play music. The instrument blends color in infinite combinstions and effects



#### POPULAR SCIENCE MONTHLY

Instead broathly. Single casty, 15 cross. Yearly subscription to United States its presentions, and Canada, \$2.50; having countries, \$1. Entered as second-class master Dec. 25, 1918, at the Post Office at New York typics the act of March 3, 1879. Entered as meant-class master Dec. 25, 1918, at the Post Office at New York typics the act of March 3, 1879. Entered as monad-class master Dec. 25, 1918, at the Post Office Department, Canada. Printed in U. S. A. Copyright, 1974, by the popular Science Publishing to Low. Inc.

The contents of this magnetic mast not be regarded without permission. In presenting in its editorial columns numerous marties of new products of applied science. Portland Science Mostratus does not underwrite the business methods of the individuals or encourage producing them. The use of Publish Science Mostratus at the producing them. The use of Publish Science Mostratus at the producing them. The use of Publish Science Mostratus at the producing them. The use of Publish Science Mostratus at the producing them.

If I is the producing the producing them to the producing them to the producing them. The use of Publish Sciences is never authorized.

If I is the producing the producing the producing the producing the producing the producing them.

#### In This Issue

	WPC
Mira Ceti-en Eurloding Star	35
By Norman Bolton, F.R.A.S.	246
The Sky Speris of Tomorrow. U.S.)	26
The Science of Modern Paint	28
Dr Edward Moit Woulley	
"Do It Right if It Takes a Vest"	at
The World's Greatest Power Date	33
By Newton Burke	-
How Chlorine Cured My Cold	34
By Robert E. Martin	**
Wonders of the Deep Sen	10
Model Mano Rocket Explained	34
The Prof. Makert II Couldwrd	
Mechanical Tricks of the Carnival	39
A s fold to Walter B, Cribson	41
A Pive Room Home in Three Rooms Dy A. May Holaday	41
A Martye in the Cause of Science	43
A Martra in the Cause of Science How Chemistry Is Fooding Us	44
By Ellwood Bendvick, Sc. D.	
Practical Science in the Making	46
Money Cleans Her Washing Machine Carden Talds Voleta Like Umbrella.	48
Stereoptium I as Rulls of Film. Lorent by Has Direct Engine Automatic Teller Takes Deposits	48
Loromethe Has Diracl Engine	100
Automatic Teller Takes Deposits	40
A Back-Yord Gas Plant Furons Whietle Concerts.	30
Bird is Model for Helicoptes	50
Two Glant Lobeters	50
A Ministers Fire Engine Smallest New York Store Three Wheel Fire Trook	3
Smallegt New York Store	-51
Cutation Front Harden Winter	51
Stat bombone Broadcasts Heattheats	52
Catring Steel Under Water Stethophone "Broadcasts" Heartbeats Schway Coin Machine	5.2
Model of Hadson Tubpel	-53
Pocket Cutch Safeguards Watch	53
Organizated Garden Telegrope. The World's Most Powerful Musicet.	53
Wire Reinforcement for Brick Walls	54
Turesable for Railway Motor Care	84
World's Largest Belt	33
Automatic Door Check	35
A Thirteen Month Calendar	30
Applied Science in the Household	ST
Swinging Profulgm for Crossings.  Motorcycle Has Twin Engines.	37
Motorcycle Has Twin Engines	5-M
Service Station Deposit Boxes.	
Catooralogy Leads for Chem Cata	38
Proved Amazonionale on Sching.	4123
Combined Tracter and Grader	4123
Aleplanes Aim at Speed Records	50 50 50 50 50 60
Combined Tracter and Grader	50 50 50 60 60
Combined Tracter and Grader	59 59 60 61
Combined Tractor and Grader Aleplanes Aim at Speed Records Wind Transel in Avantum School To Fly Arress Kongo Jungles Smoke Screen Hides Skystrapers	50 50 50 60 60
Combined Tracter and Grader Airplanes Aim at Speed Records. Winst Transel in Avirous School To Fly Arress Kongo Jungles Souke Screen Hides Skyntrapets Plantographs at Record Height Trench Forms Natural Silo	50 55 GO OL G
Combined Tracter and Grader Aleplanes Aim at Speed Records Wind Tounglin Aviation School To Ply Across Kongo Jungles Souder Screen Hides Skyncrapets Photographs at Record Height Trench Forms Natural Salo Truck Orives Through Smokestack	30 30 30 30 30 30 30 30 30 30 30 30 30 3
Combined Tracter and Grader Aleplanes Aim at Speed Records. Winst Transplin Aviation School To Ply Arress Kongo Jungles Sonder Screen Hides Skyntrapets Photographs at Record Height Trench Forms Natural Silo Truck Orives Through Smokestack Roudside Barbecon for Maturists.	30000000000000000000000000000000000000
Combined Tractor and Grader Aleplanes Aim at Speed Records Wind Toungt in Aviation School To Fly Arress Kongo Jungles Soute Screen Hides Skyntrapers Photographs at Record Height Trench Forms Natural Solo Truck Orives Through Suohestack Roodside Barberge for Motorists.	30 00 00 00 00 00 00 00 00 00 00 00 00 0
Combined Tractor and Grader Aleplanes Aim at Speed Records Wind Toungt in Aviation School To Fly Arress Kongo Jungles Soute Screen Hides Skyntrapers Photographs at Record Height Trench Forms Natural Solo Truck Orives Through Suohestack Roodside Barberge for Motorists.	30000000000000000000000000000000000000
Combined Tractor and Grader Aleplanes Aim at Speed Records Wind Toungt in Aviation School To Fly Arress Kongo Jungles Soute Screen Hides Skyntrapers Photographs at Record Height Trench Forms Natural Solo Truck Orives Through Suohestack Roodside Barberge for Motorists.	30 00 00 00 00 00 00 00 00 00 00 00 00 0
Combined Tracter and Grader Airplanes Aim at Speed Records. Winst Transel in Aviation School To Fly Arress Kongo Jungles Sonder Serven Hides Skyntrapers. Plentographs at Record Height Transh Forms Natural Salo Truck Orives Through Smokestack Roadside Barbecau for Motorists. Home Cut in Half Folding Dinings Room. Ornamental Lamp of Cord. Cutting a Hape Steel Shaft Washer for Tennis Bulls.	30 50 50 50 50 50 50 50 50 50 50 50 50 50
Combined Tractor and Grader Aleplanes Aim at Speed Records. Wind Tonnel in Aviation School To Fly Acress Konga Jungles Sooke Seveen Hides Skyarapers. Photographs at Record Height Trench Forms Natural Silo Truck Drives Through Smokestack Roadside Barbecne for Motorists. House Cut in Half Folding Dining-Room. Ornamental Lamp of Cord. Cutting a Huge Steel Shaft Washur for Tennas Balls. Hese Much Science Da Year Kunst?	
Combined Tracter and Grader Aleplanes Aim at Speed Records Wind Tonnet in Aviation School To Fly Arress Konga Jungles Souke Screen Hides Skyarapers Photographs at Record Height Trench Forms Natural Silo Truck Orives Through Smokestack Roadside Barbecast for Motorists House Cut to Half Folding Dining-Room Ornamental Lamp of Cord. Cutting a Hage Steel Shaft Macher for Tennis Bulls Hase Mach Science Da Vois Kunse? Gravity Level in Three Sections	50 50 50 60 60 60 60 60 60 60 60 60 60 60 60 60
Combined Tractor and Grader Aleplanes Aim at Speed Records Wind Toungt in Aviation School To Fly Acress Kongo Jungles Stocke Serven Hides Skystrapers Photographs at Record Height Trench Forms Natural Scho Truck Orives Through Smokestack Roadside Barberne for Methalists Home Cut in Half Folding Dining-Room Ornamental Lamp of Cord Cutting a Hage Steel Shalt Washer for Tennas Bulls Hase Much Science Da Van Kunse? Gravity Level in Three Sections Know Your Car.	
Combined Tractor and Grader Aleplanes Aim at Speed Records Wind Tonnel in Avanum School To Fly Acress Konge Jungles Snock Seven Hides Skyarapers Photographs at Record Height Truck Forms Natural Silo Truck Orives Through Smokestack Roadside Barbecne for Metarlets Home Cut in Half Folding Dining Room. Ornamental Lamp of Cord. Cutting a Hase Steel Shall Washer for Tennis Balls Hase Marb Science Da Vett Kutsk? Gravity Level in Three Sections Know Your Car. An Elevator Scallold. The Progress of Radio	50 50 50 60 60 60 60 60 60 60 60 60 60 60 60 60
Combined Tracter and Grader Aleplanes Aim at Speed Records Wind Tonnel in Aviation School To Fly Arress Konga Jungles Souke Serven Hides Skyarapers Photographs at Record Height Trench Forms Natural Salo Truck Orives Through Smokestack Roadside Barbecne for Motorlets House Cut in Half Folding Dining-Room Ornamental Lamp of Cord. Cutting a Hage Steel Shaft Macher for Tennis Bulls Hase Much Science Da Vois Kunse? Gravity Level in Three Sections Knew York Cat. An Elevator Scallald. The Progress of Ractio  By Jack Brans	50 50 50 60 61 61 61 61 61 61 61 61 61 61 61 61 61
Combined Tracter and Grader Aleplanes Aim at Speed Records Wind Tonnel in Aviation School To Fly Arress Konga Jungles Souke Screen Hiller Skyarrapers Photographs at Record Height Trench Forms Natural Silo Truck Orives Through Smokestack Roadside Barbecus for Motorists House Cut to Half Folding Dining-Room Ornamental Lamp of Cord. Cutting a Hage Steel Shaft Washer for Tennis Halfs Hase Much Science Da Voic Kunse? Gravity Level in Three Sections Knew Your Car. An Elevator Scalladd. The Progress of Radio By July Bons Back Stage with Radio Mike	50 52 52 50 61 61 61 61 61 61 61 61 61 61 61 61 61
Combined Tractor and Grader Aleplanes Aim at Speed Records Wind Tounglin Aviation School To Fly Arress Kongo Jungles Stocke Serven Hides Skystrapers Photographs at Record Height Truck Forms Natural Sdo Truck Orives Through Smokestack Roadside Barbeens for Metarists House Cut in Half Folding Dining-Room Ornamental Lamp of Cord Cutting a Hast Steel Shall Washer for Temple Balls Hase Much Science Da Nati Kurse? Gravity Level in Three Sections Know Your Car. An Elevator Scallodt The Progress of Radio By Jose Banus Back Stage with "Radio Mike By W. T. Mennesi	50 50 50 60 60 61 61 62 63 65 65 65 65 65 65 65
Combined Tracter and Grader Aleplanes Aim at Speed Records Wind Tonnel in Aviation School To Fly Arress Konga Jungles Souke Screen Hiller Skyarrapers Photographs at Record Height Trench Forms Natural Silo Truck Orives Through Smokestack Roadside Barbecus for Motorists House Cut to Half Folding Dining-Room Ornamental Lamp of Cord. Cutting a Hage Steel Shaft Washer for Tennis Halfs Hase Much Science Da Voic Kunse? Gravity Level in Three Sections Knew Your Car. An Elevator Scalladd. The Progress of Radio By July Bons Back Stage with Radio Mike	50 50 50 60 61 61 61 61 61 61 61 61 61 61 61 61 61
Combined Tractor and Grader Aleplanes Aim at Speed Records Wind Tonnel in Aviation School To Fly Acress Konga Jungles Sooke Serven Hides Skyntrapers Photographs at Record Height Track Forms Natural Silo Truck Urives Through Smokestack Roodside Barbecus for Motorists House Cut in Half Folding Dining-Room Ornamental Lamp of Cord. Cutting a Huge Steel Shaft Washer for Tennas Balls Hase Much Science Da Year Kunse? Gravity Level in Three Sections Knew Your Car. An Elevator Scallald. The Progress of Radio By Jak Banni Back Stage with "Radio Mike" By W. T. Mennos Hew to Build a Super-Heterodyne Set By Joseph Calcolorso Radio Hists for Evetybody	50 50 50 60 61 61 61 61 61 61 61 61 61 61 61 61 61
Combined Tractor and Grader Aleplanes Aim at Speed Records Wind Tounglin Aviation School To Fly Arress Kongo Jungles Souke Serren Hides Skystrapers Photographs at Record Height Truck Orives Through Suchestack Roudside Barberns for Metarists House Cut in Half Folding Dining-Room Ornamental Lamp of Cord Cutting a Hast Steel Shalt Washer for Tennas Bulls Hase Much Science Da Nau Kunse? Gravity Level in Three Sections Know Your Car. An Elevator Scalkold The Progress of Radio By First Bonni Back Stage with "Radio Mike By W. T. Mennose How to Bulls a Super-Heterodyne Set By Joseph Calculates Radio History De Radio Bilde	50 50 50 60 61 61 61 61 61 61 61 61 61 61 61 61 61
Combined Tractor and Grader Aleplanes Aim at Speed Records Wind Tounglin Aviation School To Fly Arress Konga Jungles Souke Serven Hides Skystrapers Photographs at Record Height Truck Forms Natural Sdo Truck Orives Through Smokestack Roudside Barberns for Metarists House Cut in Half Folding Dining-Room Ornamental Lamp of Cord Cutting a Hast Steel Shalt Warder for Tennas Bulls Hase Much Science Da Nati Kunse? Gravity Level in Three Sections Know Your Car. An Elevator Scalkold The Progress of Radio By First Bonni Back Stage with "Radio Mike By W. T. Mennos How to Bulls a Super-Heterodyne Sat By Joseph Calculated Radio Hints for Everybody Riding the Scorm Where Is the Automobile Going?	50 50 50 60 61 61 61 61 61 61 61 61 61 61 61 61 61
Combined Tractor and Grader Aleplanes Aim at Speed Records Wind Tounglin Aviation School To Fly Arress Kongo Jungles Souke Serren Hides Skystrapers Photographs at Record Height Truck Orives Through Suchestack Roudside Barberns for Metarists House Cut in Half Folding Dining-Room Ornamental Lamp of Cord Cutting a Hast Steel Shalt Washer for Tennas Bulls Hase Much Science Da Nau Kunse? Gravity Level in Three Sections Know Your Car. An Elevator Scalkold The Progress of Radio By First Bonni Back Stage with "Radio Mike By W. T. Mennose How to Bulls a Super-Heterodyne Set By Joseph Calculates Radio History De Radio Bilde	50 50 50 60 61 61 61 61 61 61 61 61 61 61 61 61 61

And other timely articles and pictures

# NOW FRE!

# The Book That Has Shown Thousands the Way to Amazing Salary Increases

TAKE this situation. A man who had worked all his life in a routine job at low pay suddenly surprises his friends by moving into a better neighborhood, taking a big house, buying a car and blossoming out as a well-to-do and influential citizen in his new community. How did he do it? What

is the secret that he used? Simple enough. He knew that the biggest money in business is in selling, and though he felt that he couldn't sell a thing he learned the secrets that make Master Salesmen, and then began to make big money.

If only one man had found inspiration enough in this remarkable book to make a brilliant success in the Selling field—in a job paying him many times his former salary—

then you might call it luck. But

#### Your One Chance to Make the Biggest Money of Your Life

Not one of the men whose names appear above had ever sold a thing before—not a dime's worth. If you had told one of them that he could sell he would have laughed at you.

They were frankly skeptical. Yet every one of these men, through reading this book, discovered the fallacy of this vicious old idea that Salesmen are "born." They learned that Master Salesmen are made! And in this book they found a comparatively easy way to go from low pay to better earnings.

#### Simple as A B C

Sounds remarkable, doesn't it? Yet there is nothing remarkable about it. There are certain

ways to approach different types of prospects to get their undivided attention - certain ways to stimulate keen interest-certain ways to overcome objections,batter down prejudices. outwit competition and make the prospect act. If you will learn these principles, there is awaiting you a brilliant success and more money than you ever thought of earning. This book "Modern Salesmanship," tells exactly how the National

Salesmen's Training Association will make you a Master Salesman.

As soon as you are qualified and ready, the Employment Service of the National Salesmen's Training Association will help you to select and secure a selling position as city or traveling salesman.

#### Now Free to Every Man Who Will Act at Once

We are not making any extravagant claims about what we will do for you. We don't have to. The records of the real successes for which we are responsible are so overwhelmingly a testimonial of the fact that any man of average in-

telligence can become a Master Salesman that we are willing to leave the decision entirely up to you. All of this proof and many important features about Salesmanship are contained in "Modern Salesmanship." It is yours—FREE. Send the coupon for it today. It will show you how you can quickly become a Master Salesman-a big money maker. It will tell you about the National Salesmen's Training Association system of Salesmanship Training that has meant prosperity to so many thousands of menabout the National Demonstration Method that gives you actual experience while studying-and all about the fine opportunities that await you in the selling field, Failure to act may mean that you lose the one big chance of your life to leave forever behind you the low pay of a routine job.

Salesmanship

#### National Salesmen's Training Association

Dept. 18-M 53 W. Jackson Boulevard Chicago, Ill.



Chapter in

National Salesmen's Training Association Dept. 18-M, 63 W. Jackson Boulevard, Chicago, III.
I simply want to see the facts. Send me I FREE your Book, "Modern Salesman- I ship" and Proof that I can become a I Master Salesman,
Name
Address,
City State
Age Occupation

#### READ!

Charles Berry, of Winterset, Ia., stepped from \$18 a week as a clerk to a position making him \$1,000 the very first month. J. P. Overstreet, of Denison, Tex., read this book left a job on the Capitol Police Force, and in six weeks earned \$1,800. P. Wynn, Portland, Ore., on experise man, earned \$554.37 in one week. George W. Kearns, of Oklahoma City, found in this book a way to jump his earnings from \$60 a month to \$524.00 in two weeks, and C. W. Campbell learned from it has he could quit a clerking job on the railroad to earn \$1,632 in thirty days.

NTED.

I am teaching trades to men who want to get out of white collars and into overalls. Who want to quit being wage slaves. whose job a strike or bad business or employer's whim can terminate without warning. Who want a chance to be independent, make real money and own their own business.

I refer you to sixty thousand men who found the way to success by sending for my catalog.

#### Earn \$50 a Week and Up!

If you are looking for work at \$50 a week and up, if you would like to get into something sure and solid that will give you success and independence, and can put in a few weeks this winter in TRAINING, write me today.

With over TWELVE MILLION automobiles running the demand for mechanics, demonstrators, chauffeurs, truck drivers, garage men, etc., is greater than ever before. Countless opportunities in cities and towns and even remote places. I estimate there are 20,000 Sweeney trained men owning their own garage or business.

### FREE Catalog and Special Offer

Get my FREE 64-page catalog. It shows hundreds of actual photographs of men at work in my magnificent new school. Tells all about wages, profits, opportunities in auto and tractor business. Explains step by step how to learn. Interesting letters from graduates telling how they made good. Shows how men come from all over the world to this big school. Makes you want to join the crowd. Tells everything you want to know. I will gladly

send you a copy, beautifully illustrated. I'll Send This tell you how to get into business for yourself. No colored students accepted.

Now |

E. J. SWEENEY, President





is the ONLY way to learn if you want to save time and money and be properly trained. You get this at the famous trade school, the MILLION DOLLAR SWEE-NEY SCHOOL and you get it nowhere else. I have helped 60,000 men to success. The way to learn is easy. You don't need any experience, age makes no difference. I teach with tools, not books. You learn by actually doing the work. I am making a Special Thirty Day Offer. That is why you should not delay. The first step is to send for my big Free Catalog.

EMORY J. SWEENEY, President Dopt. 18-J, Sweeney Building, Kamsas City, Mo.

Send me free, without any obligation on my part, your 64page catalog and Special Offer.

NAME

GIVE AGE

P. O.

STATE .....



You men who are slaying away in small-pay jobs, hoping and striving for better things, I wish you could be with me here for just a few moments. I would show you how thousands of men just like yourself have quickly stepped into high-salnried positions and brilliant success in this fascinating field of electricity. In each and every case their first step toward this cherished goal was to write to me for the same free proof I want to send to you. They followed my advice and today are leading happy, prosperous lives-many drive their own cars, own their own homes and have plenty of money to spend for the other good things of life. They are Electrical Experto-"Cooke-Trained"-earning \$3500 to \$10,000 a year!

#### Be an Electrical Expert Learn at Home

Get into this great field of Electricity! Know the magic force, the ways and means it is harnessed for use in industry, and a thousand jobs will be opened to you at salaries far beyond your fundest dreams. Read Pence's story at the right! Let it be your guide post to success! Randreds of other Cooke-Traines! seen have done as well, and many better! And how! Samply by taking this specialized training that quickly fits any man, no matter what his age or pre-vious education, to take his place with the his-pay men of the country. You needn't give up your present job or go away to school; by this amazing method you may have right at home to your spars time.

#### \$3500 to \$10,000 a Year

Twenty years of petual work all over the world in the electrical field gave me a grasp of just what a man most learn to fill an important position. My experience taught me that a man unset know first the principles involved and then the best methods to apply and regulate those principles. Why make a man wade through a lot of useless study wasting months of preclosa time. And so, at enormous expense and years of effort I evolved a system of training that is atripped of every useless step. I will make the student a practical worker! I will place in his head and hands the means to make big montey as a skilled Electrical Expect! I will fit him in a short time to earn a princely salary, \$1000 is \$10,000 a year, for his skill!

#### Thousands of Happy Men Say "There Is No Other Training Like This"

"You have given me a most wonderful training, a training to other school can. I feel sure, approach, much loss duplicate," says F. E. Radeliffe, one of the bays who is making good in Ohio. I wish you could see the thousands of letters I get like this! John Burke of Bultimore made \$750 in spare time before he finished his training! Think what this means to you! No frittering away time serving a coatly apprenticeship! Every step in this fascinating training adds carning power. You quickly become a practical man, ready to fill a hig-pay job.

Many of my boys set up in the Electrical Contracting business, wieleg houses, repairing meters, generators, electrical appliances, installing farm lighting systems, etc. Others set up shops and spaces in garages for repairing electrical systems on automobiles, tracks, motorcycles, etc. They are fitted at once to start in business for themselves, with practically no investment. And with the big plants, even the ordinary electrician makes big more. But the Trained Expert is the man who is flow—he is the big-pay man. With the teating behind you, you can claim such as enviable place for yourself.

#### You Cannot Lose—I Guarantee Your Complete Satisfaction

You don't have to take my word for one thing. So some am I that after taking this training you can etep right into a ligh-salaried position, and you will thrill with the newly found power that is yours, that I guarantee under bond to return every cent of tuition you pay me, if you are not absolutely satisfied that it is the best investment you ever made, Electricity needs you at offern you boundless apportunity for a brilliant career. I have tried to remove every stambling block toward accomplishing your ambition. I will help you win, if you will let me!

#### FREE—If You Act Now—FREE Big Electrical Outfit

I know that it is only by practice with actual instruments and materials that a man can become a provided destroyl expert. For that reason I give you without charge or silpulation a Complete Count of Electrical Tools, Materials, and Measuring Instruments. I also formed you with supplies, chamination paper and many other things that other schools don't furnish. You actually start early in the course to work at your profession, rapidly becoming proficient, ready to do any electrical job.

#### EXTRA—A Course in RADIO Given FREE for a Short Time

The up-to-date Electrical Expert must know radio or wireless work, how to make and repair the various equip-ment. This is a mighty profitable field today, and many men are making big money in it. Because I want to make this my banner year, I am now giving this \$43.00 Course in Radio ghodately Free to new students. Don't miss this remarkable offer which might be withdrawn at any time.

Make up your mind now to get into this great profession paint. Every day not know you away that much longer from preservity and happeness! Mail the coupen today for my loc free back. How to Become an Electrical Expert, and other free proof that I can not you into the class with Penne and thousands of other Cooke-Trained men who are making princely incomes.

#### L. L. COOKE,

Chief Engineer, CHICAGO ENGINEERING WORKS, Dept. 36, 2150 Lawrence Ave., CHICAGO, ILL.

The Cooke Trained Man is the "Big Pay" Man



#### \$9000 A YEAR

The picture above shows Mr. W. E. Pesper of Allman, Overgon, to his working tops, Pence is a Cooler Testons, and his letter between shows what he thinks of thy costs buc,

Dear Mr. Coules.

Thought you would be interpreted in a hepsthill I have just gotten out regarding my new strong, Busheet is going strong, paying me new something over \$750 a munth above pay expenses.

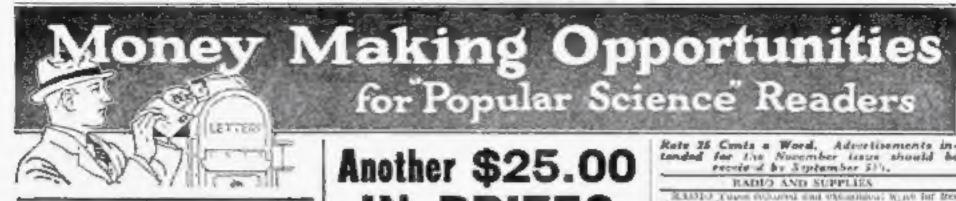
And I most though you again for my success, because it was

for my energie, because it was your wonderful course and method of instruction that put me where f am. Your true friend, W. E. P.

W. E. PENCE.

Copyriginal material

L. L. COOKE, Chief Engineer Chicago Engineering Works, Dept. 36 3280 Lawrence Are., Chicago, Ill. Send me at once "How to Become an Electrical Expert" with other proof that I can become a big-pay Electrical Expert through over Training. Register me for your Special Free Offers. You mad this PREE without any origation on my part.
Name
Address
City-
Оскаранов, принаментов в принаментов Арг.



#### AUTOMOBILES AND ACCESSORIES

PATENTE With to our Guide brooks and Russed of Invention Bang before disclosing inventions, send model or skelch of your inventions for our five Engineeries and Instructions. Terms remarkable, fee agreement on page 125. Victor J. Lyans 4 Co., 100 Ninth, Washington, D. C.

AUTOMORICLE Puris—Used parts for most any cut at half factory integries. Alen, Bruscoe, Runce, Cadillaz, Cusinara, Guevrolet, Dodge, Dort, Grant, Ruttson, Puppendille, Oakland, Overland, Oidamobile, Ren Studeboket and quary afters. Seed list of parts wanted. Cantury Auto Parts Co., 4105 Olive Street, St. Long. Etimogra.

BI 25 MIN'S a positive Headingto Test-tale Hancy Specially Co. Summy tile, Mass

RPORT Expeniator and racing bours for Ferris: become order. Build your awn livered send appealator. Send BLOG for blue prints, instructions, and life size paper patients, applicing Keiler Auto Rocy Co., Inc., Dept. 24, 317 W. Winsler Ave., Londwille, Ky.

MONEY — silvering autotights, radiators, mirrors, Refinishing tailleware, stoves, briss bods, etc., Outifie, Methods from Write—Sprinkle-Flater, Dept. 26, Marsen, Refinish from Write—Sprinkle-Flater, Dept. 26, Marsen, Refinish from Write—Sprinkle-Flater, Dept. 26, Marsen, Refinish from Write—Sprinkle-Flater, Dept. 26, Marsen, Refinish

BUY a the tion for \$2.50 and avoid stopping on the road because out of gas. Handy Specialty Co., Somer-ville, Mass.

PROTECT your springs with positive (inexpensive) spring leaf Lubricators Automatic Spring Other Co. Driver II, Corena, N. Y.

#### FORD ACCESSORIES

#### SPECIDETER fans new "Herl-j-Kon" and page 130.

#### MOTORCYCLES, RICYCLES, SUPPLIES

OVERSTOCKED FOR Date Materrysies. Must be said at once, We have Harry-Developed Indians, Renderman, Excelaiora, Casringda. Proces \$25.00 Up. Write for our Bargain List, Stycrow Brathers, Dept. C. 15 Berkeley St., Roston, Stam.

DON'T buy a bicycle motor attachment until you get eur entalogue and prices. Shaw Mig. Co., flept. 4, Galesburg, Ramess,

Call'D sarts for all majorcraics change. Schuck Cycle Co., 1932 Westfake, Seartle, Wash.

THE American School of Aviation approxime a new correspondence course in mechanics of aviation. A thorough training in practical acrossautics. American School of Aviation, Dept. 674-B, 2001 Meshapa Ave., Chicago, Illinois.

BOYS get a three foot model recopi me free. Nathing to sell. Write to Aero Shep. 2030 Histout Ave., Detroit,

#### MOTORS-BOATS-LAUNCHES

BOATS that always Go are proposed by yord cogines. Ford boat dape seek from Harry Baier, 1980 Commercial Stdg., Norwalk, Conn.

#### MOTORS, ENGINES AND MACHINERY

MOTORS—Monufacturer's Surplus Sais. 5(117, 58.50; 1417, 58.50; 1417, 58.50; 6 Vott Charging Consenture. 68.50. Complete Lighting Plants—Centralium—Light Machinery. Write for Catalog. Motor representation Co., Crafton, Prone.

CONCRETE Building block Markines and Malein, Cambous from Concrets Mappelanturing Co., 107 in., Third St., St. Louis, Mo.

#### MODELS AND MODEL SUPPLIES

HULIT & Co., 425 Judison, Chicago, Dia. Experi-mental Machinists. Model Mahers. Uses. Patterns, Complete general Machine shop, Las-Lamon.

W.R. make working mousis for juventure and experimental work, and carry a complete stock of brancesty and model supplies. Send for estalogue, The Pierce Model Works, Timby Park, Hijneig.

#### MANUFACTURING

DIES, Tools and General Manufacturing. Models and funnificturing of new inventions our specialty. Lagua Marcine Co., 126 S. Chinies St., Chicago, Di.

DEVELORING Ideas and manufacturing our specialty. Absolute authorities. 35 years' experience; write us. The K. & B. Die & Specialty Co., 2018 Elm Pt., Candidant, Obio, Dept. C.

#### FOR THE HOME

GRANDFATHER clost works \$5.00. Holid year owners instructions free; make sould profits setting year friends. Clock works with chimes for old or new cases. Write for full particulars. Clock Co., Nicetows, Pess.

GASGLING I-man, tenteron and heatern. Catalog free. Little Wooder Mig. Co., Terre Haute, Indiana.

REAUTIFUL chii's sima e binst, pitterns, instruc-tions 25c. Circular Free. Brugrens Kiddy Kaburia, 2051 Sth Avenue, New York,

PUBCIKASE a benealful Electric Funnishin for your home at Jobber's price. Walter L. Razwel & Co., 4321 Buvenswood Ave., Chicago.

SAVE 1-5 to 1-2 the money you spent for on I had year and get more heat by attaching the CHOW'N Fuel Suver to the feed door of your luminee. This inexpensive device in an amazing heat-producer and cont-saver. Works automatically—never gets not of order. Contamined to mys Siri, of coal or money refunded. Write CENCYO, 14 N, 10th St., Richmood, Inc.

### Another \$25.00 IN PRIZES

for Popular Science Readers

To win one of these cash prizes in easy, and every render is invited to enter this fescinating competition. Just write a letter of not over seventy words answering this question: -

#### What Advertisement of "Money Making Opportunities" in this issue interests you most and why?

Here are the prizes we will pay for the ten. best letters answering the above question: -

First Prize . . . . . . . . . \$10.00 Second Prize . . . . . 5.00 Third Prize . . . . . . And 7 Prizes of \$1.00 each . . . . . .

First read every one of the "Money Makint Opportunity" advertisements on pages six to twenty. Check the once that interest you. Then read over the ones you have checked and decide on the one that interests you most,

Then write a short letter, not more than seventy words, telling us why the advertisement you pick interests you most. Remembet that ten prizes will be awarded. You have a good chance of winning one of them. Be sure to mail us your snawer before Sept. 1st. The prizes will be awarded, in the order of their merit, for the letters that are most interesting and best expressed.

The names of all the prize winners and the letters that win the first two prizes will be printed in this column in the November issue. Address your prise letter to

#### Contest Editor

POPULAR SCIENCE MONTHLY 250 Fourth Ave., New York City

#### Last Month's Prize Winners

The First Prize of \$10.00 gues to George Dawson, Montreal Canada, for his letter on the advertisement of "The Union Locas Works." Here is Mt. Dawson's letter:

Deey St. —
Maney Making Opportunistee no per ade to Propiles Science, touchee the epoi every time. I seem found my chancy stabling opportunity. Though the effect of The Union Louis Weeks and, a case and profitable beniness getter at all sequence. I have at present more uniformly my own price, and there appears to be no famil. GEORGE DAWSON

Mr. S. F. Howard, Jr., Juka, Miss., wins the Second Price for the following letter re-garding the advertisement of the R. J. Carnes Company. Here is Mr. Howard's letter:

Dear Some White leoking arest Popular Sciency Monthly for a money making apportunity to take up to my square time, the advertisement of R. J. Carnen. Talingonsa. Genegia, cruck not as being exactly what I wanted. It is a real money making effer, such as I can always find in Popular Science Monthly: not a fake "get eith omich" scheme, but a fulr, mraigheinreand, men appuramenty for more general who is hooking for more. Dear Sare any person who is larking for such.
S. F. HOWARD, Jal.

The Third Prize goes to C. M. Reynolds, Spruce Creek, Pa.

The winners of the other seven prizes are: -S. E. Miller, Carry, Po., Mrs. Bartha Breaks, Long Prarie, Minn., James E. Nebla, Tur-anto, Canada, Estar Hawkes, Drummand, Idaho, Julian B. Tethill, Sayollia, N. Y., Gauge D. Raynolds, Altoura, Pa., and James Montiers, Canton, Ohio. James Manticpe, Canton, Ohio.

Rate 25 Cents a Word. Advertisements intanded for the Neverther term should be received by September 51%.

#### RADIO AND SUPPLIES

HADD Tupes subared and examinous was for free strengt, "How to do Away with morage Ratheries on All Pubes," C. F. M. Radio Tube Works, Esset Court, Newark, N. J.

Newask, N. J.

REDIO Communications 2007 100 worth, \$24.50. Hattery
Continue O war north, \$8.50. High speed Motors. Motor
Communication Scientific all store. Mateur Specialities Co., Craften,

1.00 MILES to with a sub- Any Sucise the last out to ded Huttu John, including Panel Land at Floring to Vesses Radio Co. Rose PS 117, Oktober 1807,

Printed to the control of the printed that the control of the cont

#### EDUCATIONAL AND INSTRUCTION

provided so y booksee as an elect in 60 hours, provided distant. International Descripting in-come springs-41 Missouri, Desk 10.

The second of th

1879 Walton, Ave. 1879 York, 1879 Walton, Ave. 1879 Walton, Counses in Arithmetic, Alphanic, Gentantry, Memoryanico, Trigonography, Logarithms, Meritantry, Memoryanico, Trigonography, Logarithms, Meritantry, Memoryanico, Trigonography, Logarithms, Meritantry, Remoderation, Mark.

All. men. wo been, berg. cair. 17 to 6h, willing to screep!
Coversment Positions, 2117-5210, traveling or statistically, with Nr. Comment, 285, 93, Louis, Mo., Incresidately, 1977-1977 TVIIS present everyware; cities, towns, Particular Free, Write National Detective System, 186 Just 19th, New York.

Particular from Write National Detective System, 186
Last Pul, New York.

File Main, Brahemen, Responsence, Stoccing our,
train porters (notered) Stan-6888, Experience unrecommer. 938 Railway Rureau, Rast St. Louis, 18.

WHITE photograms; \$30 cach. Experience onbecomery; details from to beginners. Protocory Langue.

Str. St. Louis.

RACLWAY Mail, Posterilles Clerks, Curriers, Contains, and make other positions open.—\$1409.82300 years, Write taday for his pure booklet showing how to shtain car of these desirable life positions. Chicago Civil Services College, T-70 Konner Building, Chicago,

Bill a detective. Largical opportunity to earn big energy travel, thousands of dollars offered in rewards. Headdished 1909. Particulars free. Write to G.T. Lud-wig, 424 Westever Didg., Kannas City, Mtc.

MEN Experience unnercensty; towel; mass secret incominations; reports; salarise, experience, Write American Fereign Detertive Agency, \$11, 84 Louis, Ma.

RAILWAY Poetal Clerks—Stars \$1.3 satath. Hajingod pure expenses paid; questions free. Columbus Institute, N-2, Columbus, Oblo.

DiffECTIVES Earn Big Money, Excellent oppor-tion, Travel. Faminating work. Experience un-country, Write George Wagner, former Government selective, 1968F Broadway, N. V.

#### TRADE AND TECHNICAL SCHOOLS

EARN \$10 to \$20 per day. Learn size painting, Auto painting, decorating, paperhanging. He an expert in a low weeks—Law cost.—Actual work—No books—Catalog Free. Chicago Painting School, 157 West Austin Avence.

CRICAGO Technical College stiers short, intractive practical courses in Drafting and Engineering—rivil, speckablest, electrical, structural—Architecture, Building Comparagration, Plan Resulting, etc. Courses Streit to your seeds. No time busied, Instructors are experts, Graduates in demand at his science. Opportunities for partitive work while studying. Day and evening classes, risk year. Enter any time. No special preliminary remains required. Low tutium—energ terms. Write for \$3-page Blustrated Blue Book, describing apportunities given to our graduates. Chicago Technical Culture, 22 Chesaro Tech. Sudding, Chicago.

Bl a Orickinger. Attend a second operated by Building Contractors. These Months Ltay Course \$75.00. Assignment Supring Implayers, 128 A. B. E. Building, Grand Results, March.

#### WANTEE

WANTED: Light M. Calbry, L. Man, Bull Present, Model High Speed Gasoline and Steam Motors, Bost Cash Priors P.I.d., Motor Speciallies Co., Cratico, Penns.

DETECTIVES needed everywhere. Experience un-necessary. Particulars fine. Write, Course Wagner, former Coverament Detective, 1985 P. Browlens, N. T. WANTED Representatives is every fictory in United States, Provider Educate Monthly, 235 Main Street, New York.

#### AMERICAN MADE TOYS AND NOVELTIES

(of PORTUNITY to start Manufacturing Mct., Toys and Novelium En superience necessary. Anomalis demand exempts supply. We furnish, at cost, natingularins for production and buy entire output, also place yearly contract orders. Casting forms made to order. Catalog, advice and information free. Metal Cast Freducts Co., 1898 Boston Read New York.

More Money Making Opportunities on pages & to 20



### Making Successful Men by Home-Study Training

How can I make more money? How can I advance more rapidly in business? Literally millions of untrained men—yourself, pethaps, among them—are continually disturbed by those two questions.

"Be industrious; keep everlastingly at it"—that's the way the writers of copy-book maxims would tell you to go about it. But honestly—are you fooled by that sort of talk? Why, you yourself know dozens of fellows who work just as hard as beavers, yet draw barely enough to keep them alive!

Argue it any way you like, it takes something beside mere speck to push men ahead—it takes specialized work.

And to suggest, for a second, that an untrained man—no matter how hard he works—is going to be promoted to a highly specialized position—such as that of Auditor, or Traffic Manager, or Sales Executive, or Expert Correspondent, or Production Manager, or Legal Counsellor—without first equipping himself for that position, is as absurd as to intimate that the boatman in the park who has been on the job for twenty years is likely to be chosen captain of a trans-Atlantic liner!

Recognizing these facts—and surely no one can dispute them—what is the wise thing to do to change one's situation for the better?

Many a happy-go-lucky chap will tell you that all you need do is to keep your eyes open and promotion will take care of itself.

It will. But, oh, how slowly!

While one man is advancing by this tedious route from \$25n-week to \$30-a-week to \$35-a-week, another chap, not a bit smarter than he, is climbing from \$15-a-week to \$30-a-week to \$50-a-week to \$100-a-week.

If you doubt it, look about you! Talk with the men still in their twenties and early thirdes who are swinging \$5,000 jobs?

No—there's more to advancement than merely "catching onto things." TIME is the all-important factor—and that is the big reason why thousands of earnest men have refused to wait, but have turned instead to LaSalle Extension University and have shortened by many years their journey to success.

That they — in so doing — have acted to their own advantage is borne out by the fact that during only three months' time as many as 1193 members reported definite advancement which they were frank to attribute to home-study training under the LaSalle Problem Method. The total salary-increases so reported amounted to \$1,248,526, an average increase per man of eighty-nine per cent.

Your future is, of course, your own problem—and no one can solve it but yourself. If you are content to drift, you will find plenty of company though little profit.

If, on the other hand, you are really in carnest when you say that you want to get ahead in husiness, you will find both companionship and gain in home-study training under the LaSalle Problem Method.

Below this text there's a coupon—very similar to the one which has set many, many thousands on the path to success.

A good way to gauge your strength of purpose is -- by what you do with that coupon-NOW.

### LA SALLE EXTENSION UNIVERSITY

The Largest Business Training Institution in the World

~					
LASALLE EXTENS	ION UNIVERSITY	Dept.983-R	Chicago,	Illinois /	P. Commission
Please send me catalog and Also a copy of your book,	full information tegrating the coun- Ten Years' Promotion to One," all	et and service I have me without obligation to fi	arked with an X	below.	
Daningus Managements Tenining for (Michael Managemai, Salas and Departmental Executive positions,	Consention Training for position as It.	the agences Prosperint	ser to Works blen-	Links Training #11/1/	
Medera Salestantahip: Training for pul- tion as Sales Execution, Salesman, Sales Crant of Trainer, Sales Promition Manager, Monufacturer's Agent Salishor, and all posi- tions in retail, wholesale, or specialty selling.	Expert, Freight Solicitor, etc.  Radiway Station Management: Training for position of Sistion According Cashier and Agent, Division Agent, of Bunking and Florance: Training	sent Manager 1	the position of Per- ndustrial Relations next Langue, and	Copy Writers,	data Training for Correspondent with
l'Agher Accountmey: Training for and- tion as Auditor, Comptroller, Certified Public Accountant, Cost Assessment, etc. Law: Training for Bar; LL B. Degrac.	Financial Institutions  Financial Institutions  Modern Formula for positions in Sh Management, such as that of Super	and Practice: Trui Baies or Collection C Premories Manager	ning for position in arrespondent, Sales , Mail Sales Man-	Effective Speakin art of forceful, et Ministers, Selemen Pulticians, Clubmen	g: Training in the fective speech, for Fraterial Leaders, a ric.
Contraspectation Service for Significant Mer-	Sub-Perman, etc.		ings Training for	C. P. A. Conching	for Advanced Ac-
Neme	Present Position		Address		

### \$90 Drafting Course FREE

There is such an toward demand for practical, trained Draftsmen that I am making this special offer to deserving, ambitious men. I will teach you to become a Draftsman teach you to become a Drawing and Designer until you are drawing a calary of \$250.00 a month. You need not pay me for my personal instruction or for the complete est of instruments. But you must take advantage of this special offer stress.

### \$300 a Month Salary-\$450 on the Side At Home

That's the kind of money my drafting air dents make. Read what this one says;



"As a beginner I om diving fine. Am arraing a satery of \$300 per mouth, besides I made over \$450 at huma the last two memble, derouring plane for private parties. The practicul drafting training you gove me by mail put me where I am in less than as mouth's study. Thenk you for all your personal inderest and help you gove me to Jar." (Signed) J. E.

Write and I'll tell you how I make you a firstclass, big money earning draftsman in a very lew months! I do this by a method on other

#### I Guarantee |

To train you until you are placed in a position paying up 1, \$250 and \$200 a munch

man or institution can imitate. I give youpersonaltraining at home by mail un-til you are actually placed in a position paying up to \$250 and \$350 a month. Six thousand draftsmen wanted every month.

#### This Outfit FREE

give you n whole set of drufting tools the minute you become my student. You get every tool you need. A magnificent set of instruments which will build your success



### Coupon

at once for my great book - "Successful Draftsmanship." Find out about the simply marvelous opportunities ahead now. What marvelous opportunities ahead now. DOM: PORTING DOMESTICATION NO. Send the coupon for free book TODAY!

Free Course Offer Coupon CHIEF DRAFTSMAN DOBE

1561 Laurence Ave., Div. 15-66. Chicago Without any obligation to me giams and your book, "Burnessto! Destinantship" and full per-ticulate of your Rhoys! "Personal Instruction" of-fer to a few products. It is understood I am will-gained in an way wholever.

None_	 	49	

#### Money Making Opportunities

ADVERTILING

ADVERTISING rates for magazines and weeklesse. Charles A. Lutz, Apartment 241, York, Principles

21 WORDS combine list of 70 Sunday and weekly swingers, \$4.06. AdMayor, \$113 P. Harthers, St.

ONE lock to 138 N. Y. Country Weekhes \$15. Cally one cut broded. The Messenger, Smillstown Branch, Long Island.

AllValerISING in all magazines and newspapers at publishers become rates shim letters, booklets, foldows, planned, written, Blustraied. Taplor's Advertising Ser-vice, Dept. A. Freeport, Bluster.

MR. ADVERTIBER: Ask to-day for a copy of the "Cuck-Action Advertising Rate Folder." It customs some really important forth which will prove interesting and valuable to you. It also tells "How You Cut Une Popular fencies Monthly Productly." You'd like to know, wouldn't you'd Manager, Climbial Advertising, Popular Selection Monthly, Ell Worldish Street, New York.

PRINTING, ENGRAVING, MULTIGRAPHING D. Elliott, 365 houth Third, St. Leuis.

COMMERCIAL Printing Write requirements.

500 Two Calor Letteriscois, \$2.75. Samples fron.

BETTER Printing for Lass Minney. Write us about your printing needs, and you will save money. Present Fantum Compuny, 525 South Deurborn Street, Chicago. EMBORRED business, person I stationery. Samplemp. Duniels F. Communy, Printing, Printing, Printing,

VOUR name and address printed on 100 line cards he bile, prepaid. Greenfield Printing Co., 191 Getern St., Breeklyn, N. Y.

100 EACH, Letterbeade and Envelopm, \$1.50. Cul-popper From Ben ed, Fulth, Ark.

TRADE-MARKA betterbead designs, Blastrations for advertising Letters, Solders, booklets written. Quick service, Lie prices. Taylor's Advertising Service, Legs. odvertising Letters orivier, fair prices, B, Françoit, Immos.

SIMPLE Photo-Engraving Process. Line and Hill-ce Cuta Perticulars I rente. Harton and Police,

#### GUMMED LABELS

NAME and address, Son me. Charts rule or host Stationery, 200 shows and list services practed \$1.06. Eastern Labet Co., B. Chartenville, Com-

#### DUPLICATING DIVICES

Prints Typewriting Handwriting, etc. On Approval.
Prints Typewriting, Handwriting, etc. On Approval.
Prints Specialty Co. 3-X, Prints, Ps.

MODERN Dupliestors, asys Time, Labor, and

"MODERN Duplieston, any Time, Laker, and Mency, Gras Suntana. Reproduces Typewritten or Franced Letters, Deswings, Lessons, Music, Steman Dida, Natham, Specifications, Maps or anything in one or more cases. Frince two per minute. Special mile so. 20 days' fee trial, \$2.35 up. Reskiet free. I. V. Derkie-Ressant Co., Pittsburgh, Feenerity vol.

#### OFFICE DEVICES

ADDRESSING markines, multigraphs, duplestors, bilders, cheek writers, making distalling markines, at about half new cost. Fruit, 170-X North Wells, a normal.

#### ADDING MACHINES

FRANK it's L. m. streemen new assuing teachiers. LAM.
imbtraces, moditative, divides, substractivally work
requisit \$600.00 assesses. Five-year guarantee. Used by
strante, handsome. Five-year guarantee. Used by
strante componentiess. Witte today for catalog and true
trial offer. Lightning Calculator Co., Days. O. Grand
Explois, Michagan.

#### BRANCH OFFICE SERVICE

PITTSHURGH Office and Representation Proc.

#### LETTER SPECIALISTS

30 SUCCESSIVIL Collection Letters \$1. Win, 403 Gotham Bunk Rick, New York, N. Y.

LET me write your takes letters, booklets, folders, white experience fall prices, quick service. L. Taylor, not 44P, Freeport, Illinois.

#### MAILING LISTS

12,000 NAMES Inch. as High Selmed Greekenion, \$3.00 Streets Market, Atapola, Ind.

#### LABORATORY AND CHEMICAL SERVICE

S.X.P.CHIMENTERS Complete Supplies for the chemical telepratory. Catalogue Sc. National Scientific Supply Co., 241 Fennsylvania Avenue, Wastengton, D. C. YOUR changes problem selved and working process hardeled for five distarts. Write me. W. Stechnan Richards, Cubeniting Chemist, Pan 2602, Poston, Moss.

#### FORMULAS

SURMULUS for merful and salable articles. Two-isonfred to been form. Fifty cents postpoid. Pentiard Service. I Thomas are Name & Cons.

#### INFORMATION

COMPLETE promise information on any subject of National Information Bureau, 1429P Million 18., Grand Rapids, Michigan.

LEGIAL questions are wered, guaranteed corner, \$1.09, Digar Kriler, August . Municipal

#### INCORPORATIONS

DELAWARE Incorporator. Charters Fees Small; epis. Chas. G. Guyer, 801 (trange St., Wilmington, Detamare

INCORPORATE Delicator, P. Lewis Mettler, Kill arket St., Wilmington, Del. (Entablished 1900.)

MR. ADVENTUSER: Ask to-day for a rapy of the "Chick-Artison Advertising Rate Folder." If opening some reality important facts which will prove interesting and valuable to rea. Manager, Chambred Advertising. Popular Science Monthly, 225 West 19th Birnet, New Turb.

More Manay Making Opportunities on pages 6 to 20



### HIGH SCHOOL COURSE IN

YOU ARE BABLY If you lack HANDICAPPED High School training.

You cannot attain business or social prominence. You are barred from a successful business career, from the leading professions, from wellpaid civil service jobs, from teaching and college entrance. In fact, em-ployers of practically all worth-while positions demand High School training. You can't hope to succeed in the face of this handicap. But you can remove it. Let the American School help you.

FIT YOURSELF FOR A BIG FUTURE This course, which has been prepared by some of America's leading professors, will broaden your mind, and make you keen, alert and capable. It is complete, simplified and up-to-date. It covers all subjects given in a resident school and meets all requirements of a High School training. From the first lesson to the last you are carefully examined and coached.

#### USE SPARE TIME ONLY

Most people idle away fifty hours a week. Probably you do. Use only one-fifth of your wasted hours for study and you can remove your present handicap within two years, You will enjoy the lessons and the knowledge you will gain will well repay the time spent in study,

Check and mail the coupon NOW for full particulars and Free Bulletin.

#### American School Doots H675,

Branul Rou, and 14th St., Chicain &

American School

Dopt. H675, Dressii Ave. & 58th St., Chicago Send me full information on the subject chacked and how you will help me win success. Architect

- Building Contractor Automobile Engineer Automobile Repairman Cleil Engineer Atroctural Engineer Suciness Manager
  Cert. Public Accountant
  Accountant and Anthor Bookkerper
  Denftmens and Designar
  Electrical Engineer
  Enerty Light & Power
  General Kowation
  Verstineal Gendance
  Deniespe Law Bookkerper
- Machine Shee Practice Photopiny Writer Mechanical Engineer Shop Supermisedent Consistent Manager
- Foremanning
  Familiary Engineer
  Surveyor in Macpings
  Telegraph Regineer
  High School Graduats
  Fire Insurance Expert
  Wireless Radia
  Undersided

Congress male of

Be A SKILLED Workman and Hold Your Job in Dull Seasons



Do you know that even when work seems hardest to: get but ing contractors are companing that they can t get enough skuled carpenters? A most any man that says he is a carpenter can get a job in the building season but it depends on what a man KNOWS whether he gets had off at the first dub week or not. Spare time reading and study of AUDIL'S GUIDES will help make you the kind of smiled workman that is never out of a job.

#### New Ideas-Modern Methods-Short Cuts

This course "Aude" a Cuidea for Carpenters. and there commend it hands volumes of over did pages will to roughly illustrated tharts. agrains, graphs port on with michthem is completed in a time that the big bigs with the firest new in the broad and betterned a range themselves in males to an to be my both to the second of the second o ly and that hid. There are 1 00 at that the in her of site ent construction work with new tion and wall help on with met man, ideas, indutions, parts, systems, comes up in your daily work,

short cure time and labor saving suggretions new mays that rever he entire theory and practice of the subject Bustraced by aketches and forms all specific and practical. Auterthe es give you be short call professional informs are you want. An need to guess or take councer. Every may you have before you is the set the case to practical, useful informaon with every job that tion had will belt

#### Thousands Say Guides Are Carpenter's Best Friend

I find the Codden way have a made be stored in the manual made be supported in the manual made in

"Valuable for Old Timers"

have maked top Audit Culd a and find a scattle of biforma-tics. This star

It is the most
house over the relations o
worth that I rave
excess in respect
with It is the vey
house that the
historian mechanic
meeds wave day

The Guides are lift a verificated and should be in he hands of all For Bandin sil all possing cardyontres are twell in a lost of the rakler lender II had after reaction 20 y yet ages they tweld have at well made

ple a parada ten treme cape ng to hugad a berne can e n ayar \$550 or m. or by upong the industry pung the industry pungs the proper punks. We be wreath flow? T necessaries. Often

"Good Per

Amateurs'
The laude ne-merly worth thor-last the greethale

on hed in the speed and in the speed of the real man the speed of the



#### Condensed Contents of Audel's New Guides

Gulde No. 1 -Over 431 paper (200 (Castrations How in make a work house,

- How to know the different kinds How to use the different hinds

of smooth of detailed information

of the hard p. F. op (if a president and band man also kand-od (juw a up the steel square.

if he to she the steel square,
if he to she he made a saw,
line to the god as agen,
line to make would so a.
line to the total so a.
line to be total for the total so a.
line to be total for the total so a.
line to be total for the total so a.
line to be total for the total so a.
line to be total for the total so a.
line to be total for the total so a.
line to the total so a.
line t

- How to understand curposite a

produce to 14 re - a and related productly How to inderenant Digition

tiv More as universomeration perfe-

ieros 15 os do cotámente (he ni resignio nf umbers.

Gutde No. 3-Over \$15 pages -100 ill natrations

There has no a some found stable.

If we have I i selected a see it is not to consider we have to the interest of the interest

Civity in tented forms the residential fit of the proportion formed them ( metaphy). It is not remove them on the control of t

- How to cut an word, how and ... How to halld states. rectat shingles

How to tay in redit.

line to put on siding. Now to put my exercise tries, Now in the cornice work.

How in make a miler free. How to make a mile shouling

- Hew to planch and level work. How on one the challe has,

Here to lay our work Have to use rates and arrive.

different in some attendache einzegenntendache sollen sein des seinen se

Guide No. 2 Over 450 pages 400 illustrations

there is go queriesn bennun M. Lenning der aumgenöber Josefin viert gleine.

is a draw up specification.
I was allow up specifications.
I was allow which Mithigan printing winds, and

How to attack lash to pured Non- co frame temperary and

to design by the his a good allowance to be a designed of the second of

to the description to make the property of the

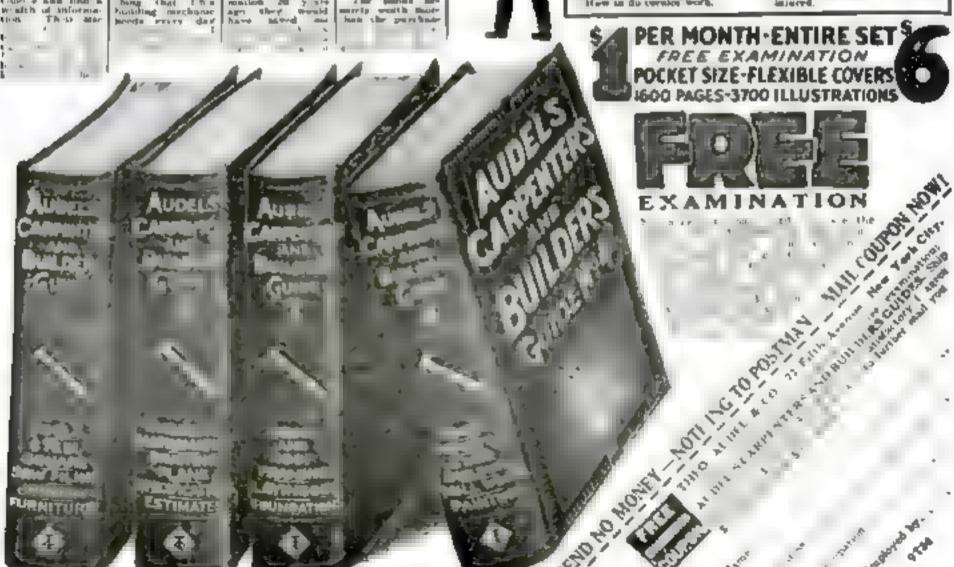
Gulde No. 4. Over 440 pages 400 Hiustrations

· How to fash.

-they to be for force

- How to put no toterior trim. - flow to point

flow to give first aid to the inneced.





### "What would I do if I lost my job?"

CUPPOSE your employer noti-S fied you to-morrow that he didn't need you any longer? Have you any idea where you could get another position?

Don't have this spectre of unemployment hand nd over your head fernyer. Trem yourself to do some our thing so well that your services will be in demand. Employers don't descharge such men. They promote

Decide to-day that you are found to fet the special and training you must have if you are ever going to get-and been-a real job at a real squary. It is easy if you really try.

Right at home, in the odds and ends of spers time that now go to wests, you can prepare for the position you want in the work you like best. For the laterational Correspondence Schools will trees you just so they are training thousands of other men -oo matter where you live no matter what your discountissees.

At least find out how, by marking and mailing the soupon printed below. There a no cost or obligation, and it takes only a moment of your time, but it may be the means of changing your whole life.

#### Mail the Couson To-day For Free Booklet

MYERNATIONAL CORRESPONDENCE COMPACT Bre 7846 U Berneten, Penns.

Without cost or absigation on my part, please tell me have I man qualify for the position of in the subject forms which I have marked as N

#### SURINGS TRAIDING COUCSES

Durinne Blatting chieft

De ope at Management

Furnomed Organization

The file Management

Harde by any Management

Annual argument in long of Fall

Annual argument in long of Fall

Steber of the Assessmithing

Its about the Control Assessmithing

The management in long of Fall

Steber of the Control Assessmithing

The management in long of Fall

Steber of the Control Assessmithing

The management in long of Fall

Steber of the Control o

TECHNICAL AND IMPRATRIAL COURSED

TECHNICAL AND IMPORTANT TO LIGHT FOR THE ADDRESS OF THE ADDRESS OF

Architect
Archit

Places.			
Address.			3 41 24
A delicated -			
The second second			

Detailed to the last Parsons received in Counts about and this conjun-tarionistic Correspondence Arbeits Countain, Lie Houleut, Corode

#### Manny Making Opportunities

#### PROTOGRAPHY AND SUPPLIES

High of the a late " With the for the state to define.

Specialized State of the first of the first of the same of the sam

and and print you can find Complete be a felt no classes. Hence guaranteed estado screen 5 h mulai 600

to the state of the second of the first of the second of t

the same of the sa

#### AUTHORS MANUSCRIPTS

O Set for the expansion but designation for part's appropriate ancientation designs from Francisco to a set of the control of

to be the second process of the second for the on the stage of Bridge Self-and The Bern

Note: the property of the prop

#### BOOKS AND PERSONS ASS

MATCHE OF THE TOTAL A STATE OF THE SALE A STATE OF THE SALE A STATE OF THE SALE AS THE SAL

The public of the of any own We will all and the public of the public of

#### M. ST. AND MUNE OF INSTRUMENTS

by a five for their traces and har a Holy or a more early fields been discussed and har a marginary. In the contract of the co

#### PHOLON RAPIES BEATIN IS BEE

The party of the p

#### MOTERS PLITTER BUSINESS

#### WINSSESSEE AND ADDRESS OF THE PARTY OF THE P

Charles of the state of the sta

#### OPTICAL COURS

(BESTER ST. | Com. 63 Booklet free Tenant Option

the to buy the street characters to buy the street and a recept of the street and a street and a

#### MAGRIC TRICKS

The his of a me of a point for a series of the series of the point of the series of th

#### LEVIE THAN

Carlo II provide at the Children Children in the Carlo II from the Carlo II for the Carlo III for the

#### MARKETTANICES

Fig. 1. Can do not be a calculate the second of the part of the second o

#### TOR MEN AND WOMEN

The real part of the property of the property

#### FOR SALE MINIFILIANTOLS

product to the form of the same of the sam

More Money Making Opportunities on pages 6 to 20

## ARN'3000 6 9000 a Year

Enter fast growing radio field, thousands of hig pay jobs waiting for you. U.S. Gov't., Staumahrps, R. R's., Corporations caparty seek Radio transet mes. Advancement racid, mara from \$3000 to \$600 yearly.



#### Prepare for Big Pay in Spare Time

My reputation as Radio Engineer and matractor insures you comand matractor insures you complete, speedy sucress, at home in a paretime; soon white you ware, in make you expert to take designing and teach you only practical inside dope. You quickly complete the paretime and step out total Big Pay. No enter the paretime and step out total Big Pay. No enter the paretime and step out total Big Pay.

pe lence required

#### FREE 1000 MILE TUBE SET

For a short time I will give tobe such For a short line t will gree to each such as a babilisme rate not to man who want not to man who want not to man who want not on FREE meader-book of lumina Ratio dope

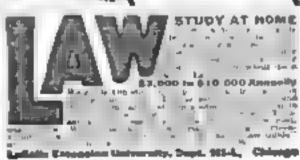
A. S. MORADOT Radio Registeris.

A. S. MORADOT RADIO REGISTA.

did i Verserverd Arrens. Supt. 10. december There for Send me your Filit's Raghe South and your Rudbak plan without cost or obligation. Bujd. 10, 61053-00









### I Will Train You in a Few Weeks-Set Up Your Shop in a New Easy Way

N what other profession can you start earning \$50 to \$75 a week right from the start? Burbering always has paid well. But now, with the added women s trade it has become one of the highest paid professions—right on an equal footing with law medicine and other lines that require years of co-lege training. And you can now equip yourself for this dignified, clean, pleasant work in a few short wieks. You can have advantages over the ordinary barber. For under the famous Moler system you are taught new scientific methods that please men and women and never fail to attract extra business. You are made a specialist in your line and you get a specialist's pay.

#### Experts Train You Right

There is a Muler school near your home thirty in all throughout the United States and Canada. Here expert instructors, recognized by the profession as the most expert in the world, teach you the little secrets that will make you the most sought after burber in your locality-and the best poid. In a few short weeks you become far better trained than the ordinary burber who must spend two (uil years to an apprentice.

#### Earn While You Learn

And under the Moler system it is possible for you to earn money while you are learnmg. Thousands of young men acknowledge a debt of gratitude for the help we have

given them help that enabled them to quickly step from the rut of low pay into a hundred dollar a week profession,

#### Your Shop Equipped On Easy Terms

We have even worked out a plan whereby you can, if you wish, own your own shop, on easy terms. You can own one of the authorused. Moler shops—part of a national institution. One of our graduates writes, "My shop has doubled its receipts since becoming one of the Moler chain shops." Our national advertising gives you a tremendous advantage, \$1,000 a month is not unusual for Moles shop owners.

#### FREE BOOK

Learn now how you can quickly become a Moler graduate—an expert in bobbing and marcelling, mechanical massage, electric hair cutting, scientific treatments and all barbering for men and women, and take this short cut to big pay. Other Moler graduates tell of earning \$100 to \$150 a week. Why not you? The best shops know that Moler graduates mean extra business for them. A Moler molema rates you anywhere.

Our catalog tens you sust how you can get this training, much changer than you would ever imagine, right in your own locality. This interesting book will be sent you free. Simply mail the coupon. But don't delay a single day in finding out how you can easily and quickly enter this modern and well paid profession. Get the coupon in the first mail.

#### Pick Out the Moler School Near You-MAIL COUPON

(30 Branches in United States and Canada.

Chicago, III. St. Louis, Mp. Kunese City, Mo. Dallas, Texas Cincinnati, Q. Cleveland, O. Detroit, Mich. Denver, Colo. Omaha, Neb. Milwaukee, Wis.

New York, N. Y. New Orleans, La. Atlanta, Ga. Memphis, Tenn. Houston, Texas San Antonio. Texas Seattle, Wash. Tacoma, Wash. Spokana, Wash.

#### MOLER SYSTEM OF COLLEGES

(Welte Neurost Branch No Street Address Needed.)

Please send without obligation your Free Bookist C and Full information.

Name

Address

### FROM BUCK PRIVATE to \$3500 in RADIO

"When I napsfled with you I was a "buck pri-vate" in the army. He appays had I received my discharge than I opened a Radio Shop of my own in my home town. I made over \$1,500 to any was work. town. I made over \$3,500 in one year work-ing for myself. Now, that I have the National Budie Institute control beneath my hat, I wouldn't have missed it for a mallion dellare."



(Signed) JOHN P. ZINNO

Coronny L. L.

INNO'S case is only one of hundreds L Every day letters pour into the offices of the National Raum Institute testing almost the lag money they are making as a res it of this easy method of becoming a care \$43 a week and commission "-"! cleaned up \$405 in one month"-"Earned almost \$1,000." These are only a few experiences of graduates of this famous radio actrool.

Take advantage of these wonderful opportacities to step into a bag paying position. io this great new field. Radio offers you an opportunity to travel and see the world, with all expenses paid, and a fine inlary besides. Or you can stay at home and work up to a position paying up to \$10,000 a year. One of our recent graduates secured a position one week after graduating paying a calary of \$300 per month.

#### Easy to Learn Radio at Home

Radio is the "wonder field" of today. Thusands of trained ones are needed in this field. Salaries of \$3000 to \$10,000 are common. Employers are constantly writing to the National Radio Institute for Radio Salamen, Radio Engineers, Radio Operators, etc. They offer \$50 to \$300 a week for National Radio Institute graduates. There is a golden opportunity in Radio for You. Don't let it slip away,

No matter how little you know about electricity or Rudio, no matter what your age or education is, the National Ratio Institute will guarantee to make a radio expert of you in a few months right in your own home. The lessons are as easy as A B C. Almort before you know it you will be qualified for one of these big pay

#### Send For Big Book

Sample his an ancimual the coupon for this 31 lage lack, 8kh Rewards h Rada which will show you exactly how rath will don de and tres e your pay in militare actual let ees to any haw hangerels have mastered Radio in a few monats and new earn more money than they ever dreamed of. Make this your lucky day. Mail the coupon now. And say good-bye to hard Circle 5

National Radio Inville Washington, D. C.	to, Dopt 12-JA,
bernell one for bonds. But	h K = r in Harls
who wall a noth	graph the Ba
be incut to be not	
	I have no firm
	of the F decisions.
gast a too the state the control of	Grand Behalt trief
Name	4-
1	
Address,	
City	44.41
5417	-72

#### Money, Making Opport

MAIL UNISER BUSINESS

If a work evenings I make it. Mail order four two for a large fells how mample and plot use. I ten, a at the high things for a defend him high the first high the first high the high t to be by the and keep a resign of the second in the second

MOTOS PICTURE BUSINESS Periods from to beginners. Preduce a Length of

ORCHARDS AND FARM LANDS

ORCHARDS AND FARMCIANDS

But to the second factor chains produce from adjusted to the second of the

JANCE MEES the stell is to the state of th

Bras or house with any to proposely at Produce to the State of the Sta

he effect heat That page steep buildings.

DATE CALAXIBES WASHING the formal has been as a street of the representation of the repre

POR ENTENTED AND A STATE OF THE PROPERTY OF TH

To a To the second of the late or many state Principles. Her of the literature and the order of the state of the s

mu pa " eter p pr top a un pr n Para e terpara a diarrer e francisas the state of the s

The same state of the same of

PATENT ATTERMENT

PATENT ATTERMENT

Solve per lost report and advance. No line on fact

or post in the for three Squares and for or

a Patent and to no my past being the or

to real Patent and to he may past being the or

to real Patent and to he may past being the or

to real Patent and to he may past being the or

to real Patent and to the fact that the patent of the

to real Patent and to the fact that the patent of the

to real Patent and to the fact that the patent of the

to real Patent and the fact that the fact that the patent of the

to real Patent of the fact that the patent of the paten

To the first of the property o

1 1 Description Ti. mpt 15 17 ' BY HALL IN M. NAME.

The state of the s

Mara Money Making Opportunities on pages 6 to 20

### \$112,000 in prizes

### For Inventors

What chance have you to win one of the prizes -some of them amounting to those soms of nonlars which are now being obsered for use at inventional. Here is a piorious opportunity to earn a handsome eum of money if you know what to do. Thousands surely will try for these prizes, but, as you know, those who have some training in posit of invention have the best STORY OF WHE

#### A Fortune for You

Big as these prises are, they don't begin to compare with the money some inventors have carned. Even simple things—like the humped hair-pin, the metal-topped ab wlace the pent t craser-shave bringer their inventors washing and as explaining also, can develop your inventive instanct so it may bring you all that you have over dreamed of. It doesn't matter who you are, where you live, what you do-you have the ability to invent, which can be strengthened and as eloped so at will be worth real money

No longer need you let you read scool restance to be to be a mean wall how are such if wer howly learning and make suit aleas pay ton Punes | he trough with most people is that they do not know what to do with their ideas. Millions of dollars go to waste because of these undeveloped of an Amateria fast time to be one learn to harness your thoughts and make them work for you! One it le myen tron, properly developed, may make you in dependent for an fi

You Can Learn to Inventi

9 you ever had an fired A SECOND OF SECOND ) hen fatheur abven de the mail to be unique
the mail to be unique
the per circ displacement
the per circ displacement
the mail perfects to the mail
the mail perfects to the mail perfect to the



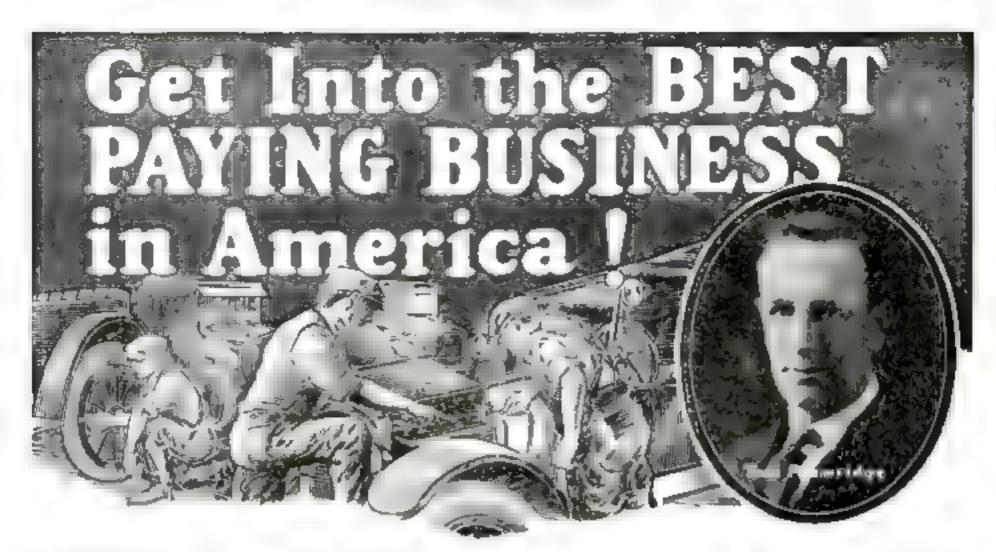
by a do to the annual company of the annual

#### Writefor this FREE BOOK

him pain 4.7 fearly en its major thin flow but hig issured well be next to you free. I ex da a in next to detail, and proves that with res a an in next a control of the c a prentote learned only of a me to a sea and bitter experience. is not connected with paten at facturers. Our only work is to teach you to a t develop your ideas so they will bring you big money

BUREAU OF INVENTIVE SCIENCE Dept. 28, Wisson Bldg. ROCHESTER, N. Y.

Bureau of Inventive Science. Lept 29. Wiener Bidg Rockeeter, N. Y. to the first of the property of the control of the property of the control of the



### I Will Teach You to Earn \$3500 to \$10,000 a Year in the Auto Field

How much are you now making a week? Would you like to earn five times that much? Why not learn at home to boss the Big Pay jobs of the Automotive Industry? Thousands of positions paying from \$75 to \$200 a week are always open to trained men who know how to fill them.



#### Free Auto Books

This hip five relience Anter References Library in FRLE to you when you start, 2200 pages, 2200 pletares, o'earth, photos, etc. Finest Actor before the world Covers away milijool, Mong to whipable reference books. Along world the most of the Course, but ALL FRESS.

#### Free Tools and Instruments



intermitors, seligibers and universal joins, a walted in Server search for detecting on the integral of the large of the lar

#### Free Employment Service

I plin you fried a falling help in ading you in get a job. Use is beful a ce af at put a preform—any time you with—an house house you with. Havengh, whose house help blance for the we do do and a do

#### l Train You at Your Home

I can teach you to become an Automotive Expert—can give you at home - in one year or less-what it took me many years to learn in English fac-tories of Dannier and Rolls Royce and in American (actories of Packard and Paign.

I Guarantee Your Success! Satisfaction—or Money Back!

Paith in yourself and ambition to learn is all you need. Are you willing to back yourself to win? All men are much alike from the head down. Invest a few dollars in your head and make it quadruple your pay, as it has done for thousands of my other students.

#### You Can Earn Big Money-Wherever You Live

Stay right at home-keep your present job-spend a few hours each week of your space time-and I guarantee to make you an Auto Expert ready to go right into a Big Pay job. This trade knows no locality.

#### Earn as You Learn Age and Lack of Education No Drawback

You don't have to be a wonder-just an ordinary, everyday ambitious man. And you don't have to wait until you finish my course before you begin to earn. Bern as you learn. Almost from the start, you can begin to make good money on the side.

#### Practical Instruction—Oldest Auto School

Everything about my course is practical—easy to learn—and easy to apply. The lessons are intensely interesting, and I furnish FREE TOOLS so you can begin to apply them at once. This School is the Oldest and Best Home Study Auto School in America, turning out thousands of successful graduates each year.

#### Be a Big Paid Auto Expert

Start today to guarantee your future excess. Send for my Big Free Book.

The Easy Way to Bigger Pay: Artisms count more than good intentions. Make the right move NOW Fill out the Coupon' I it show you. how to make more money than you ever dreamed of carming.

Tom Plumridge, Chief Engineer Automotive Division, American School

Dept. A-676 S36; St. & Drecoil Ave., Chicago, M.

#### This Free Book Tells the Whole Story Send for it Today! Here le Your Big Opportunity

If you have the ambition, I have the Training that will make you an Auto

Get busyl Win success! Be a hig men in this big pay field,



58th St. & Drouel Ave., Chicago

Send me your free book and other toformation on how I am best get into the Big Pay Field This request is to put me un-

de	Ť	*	•	ø	•	1	a L		-							
					-			4		 	 	. ,		 	 	

City... 

### GRD DR Will Help You Scale the Salary Heights

Increase your Earning Power in the Auto Business Carego Owners 8300 to 65,000 free many Aven & Truck Salasmen up to \$30,000 per year Head Auto Mechanic \$150 h \$500 per mouth Garago Munogera

> Electrical Experts \$175 to \$350 per menth

\$150 to \$350 per month

Tire Experts \$150 to \$350 per month

Truck & Tructor Man 88.88 to 819.88 per day

Repairmen \$126 to \$250 per month

U. S. Conone figures show that majority of wage earners own less then \$1500 per year.

### SPECIAL Training Offer

Don't waste your life away in the low palary class! In I wooks I can prepare you to mrn. \$75 to \$100 per week and must as you progreen. I pay rullroad fare to Chicago and find yed allerse if you need matchess white transled I get you at care-white-poolesses job, I GUARANTEE to get you to automoldle job at good pay after you learn. Or you can go in business for yourself,

Special training group how forming. Be one of them, Rates reduced. Time payments, Special left of train - B precise - FREE. Every Auta, Truck 4nd Tractor publicat severed in actual chop with Precisional Courtes. Day and evening instruction. Chance your own hims.

#### I Have Trained 47.761 Men

Of them rees, trained by any staff of exare now in business for themselves.

#### MAIL COUPON FOR FREE AUTO BOOK

This book brings you my entire proposition and pages of valua-ble sutemobile information. It to FREE Get 1 NOW while above offers are baid open.

-- Mail This Today

Erwin Oreer, President

A Erlanding

3024 S. Wabash Ave., Dops. 1305. Checago, 18. Please send me FREE Such Bow to Section in the Agromotele Tractor Doubless, and special training after. This request does not abligate me in my way.

Manager, 1997	_			
	-			
Address				

#### Manage Making Opportunities

PAGENT ATTORNEYS

the are the course of these courses the course the cour which will the NEW Entering a Bloth on the term in the West of the start of the form. Hereof is the term that the term is the term of the term and the term of the

t North North Ideas the be subj I tell you have not not you will be the plan I not purchase to tage and not not to the tell of the tell of

IN a NEA to A all Claim their turbs Puters land with 100 feet to a proposition and part of the many series and the upon recognition to the Labelton Francis Action and Park Rose Sent Such

All I is Not open to move the for served Hundreds now was at 25 and south and grow Write of y for the bushes tell have to present parameters on to the distance of the server and the server of the se

NATE AND SELECTION OF THE CONTROL OF THE PROPERTY OF THE PROPE

fit 2.) Paten some The Hook the interior best " free level being the state of the Advert home.

TYPE Has make a property for the appropriate through the property of the prope

the Manuaco are to the appear to be appeared alabeles of the set of

#### ALLENIA CALL AND AND A WAR DIS

the first than the state of the

the property of the property o

lange monthern land thus

he could be the second of the course of the

representative

TANTOPPE Promise on emble to hay cheeks, then do by the half the major of the promise of the promise of the promise of a bytalling over the promise of the p peg a fyantala pen

As INTA Deep or see John Entitue Requir for the and old tribet supermodes rates to each as a setting of most different control of a setting of most different control of the life of the l AT EXEC There are no been littlider Requir for the

A PATH A so a perfect hands the page 4 were suffer and a more marker. By a let up the following from your following to the party of the

Table 17 to his a since reg herd language Phi belghan IT shows that I am and her reas when in the two his are a since reason in the two his his language broken How in all it is a since it is a since thousand form any language language form any language language form any language language form any language form and language form any language form and language form and language form.

Tons minors of a wast a said for one Catty

The a companion Parcial Labora a 196 South As a

Chartenary N N

COLUMN taked all-wood reader-to-infinite outs disease the section of the section of the Table

More Money Making Opportunities on pages 6 to 29

### LEARN Electricity



#### Earn \$200 to \$800 a month!

New Enlarged Course

I train you on procepting from documents to proceed a new years of the Poll a work that IT You get remarked by the Tri At training in the little that the same who may to the A. Atthactive and the set Wanding Arab mg to the Truck and I restant the form that the triple is the try Raining and the pairing and hade Exceptions to make you a thebrughly breibed, and PAY, bloodered EAPERT

### CHICAGO

The Electrical Center of the World

The whole would of absorpticity is specific that COTES Delived 3 tectpical \$1. part 4 caps to focus on the Block 1 cap 4 described \$1. part 4 caps to focus on the Block 1 cap 4 described of the World 1 tay year figure. But post training at 4.00 keV. The abdord largest and her 1 producted risections in a restrict the modern of the background industry. I do not offer a marsher of 1 odd water property. I give you just now prompted accuracy on the part of the pa

#### Learn in 12 Weekst

NOT A CORRESPONDENCE SCHOOL He best or nectors theory. I train you on the grantest entirely of air reveal appearance of any real price is the mainty of air reveal. I also give purplets Radio and Automotive reserves. I also give purplets Radio and Automotive reserves. I also give purplets Radio and Automotive reserves. I also give purplets flat a father than the bank to the head to be a father to be a sent to be a father than the continue of the continue at all the most to be a sent motions at all the most sent motions at all the most

You Don't Need Education OF Experience that a property by the latest and administration of the property of the property of the latest and the latest an

Earn While You Learn! hete students in house jobs to with a good part of their if roog expanses while studying.

Send Coupon Now

Den't deine a mireta-near test re-monetarist more for the leng we see along and fast particulars of aparent other. ACT NOW

Free R. R. Fare to Chicago Come to Change — the assetty of proston compar-bound sity—and he ready for BMC MONEY is II wooked

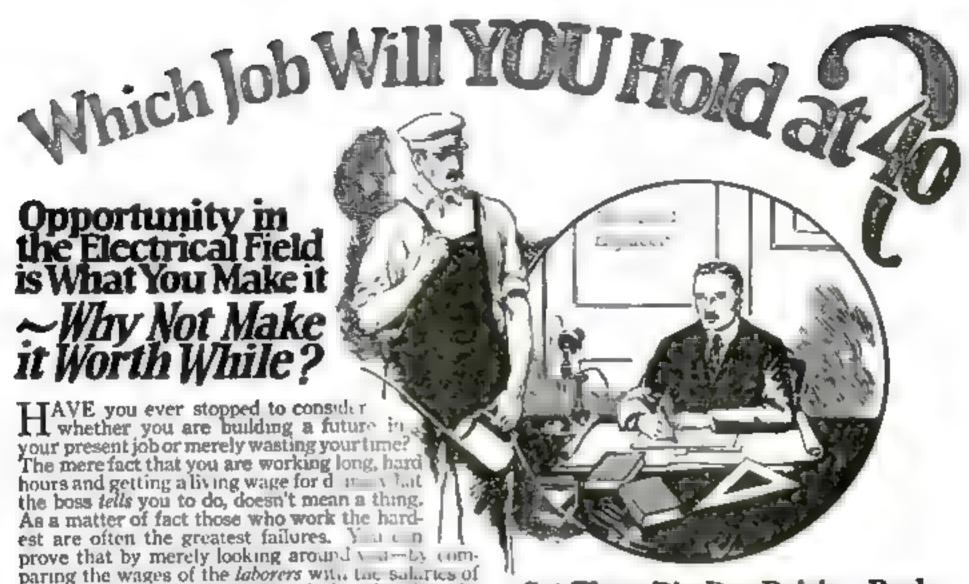


1300-1310 W. Harrison St., But. 6.1M Chicago.

_		_
a	Coyne Electrical School, Dept. 6-130	ı
ж.	Calas risculori ucusori nabr #-196	b
-	1300 INIA DE MILLE - CA CALLER	

2300-1310 W Harrison St., Chicago the H. C. Li. Wifi, Pres. Dear Bir--Plane and me free year les port est log and full particulars an fre-railrend face effer sho two free coornes.

Semi		
į	 nom	···



Why Not Prepare for a Big Pay Job?

the experts. The first get paid only for what they do; the others get paid for what they know. And because

there are more laborers than experts in every line of

business, the trained men get a larger share of the

Just look at the disstration above and ask yourself. "Which Job Will I Hold at 40?" There a no doubt as to which job you dotte to hold, and there's no reason why you can't alless and hold the

job you darke. Plenty of big pay jobs are waiting for trained men in the electrical field, but you dneed more than overals, an oil can and strong arms in order to get one. What you will need—and what you can quickly acquire—in a thorough knowledge of every important phase of electrical work. That knowledge is now available in these eight big volumes of "Applied Electricity." The coupon will put them into your home for study, reference and help at a total cost of only 10 cents a day. Why not send for them today and prepare for a big pay leb us att electrical expert?

things that make life worthwhile.

FREE Consulting

A many of the property of the second second

MAIL THIS TODAY

Get These Big Pay-Raising Books

The eight hig volumes of the "Cyclopedia of Applied Electricity" were published by the American Technical Society to help those who are anxious to increase their knowledge and pay through pleasant study at home. These remarkable books have helped thousands of ambitious men who wanted to learn the real facts about their work but were unable to devote time and money to a correspondence course or special school training. With the aid of these books you can quickly acquire a knowledge of electricity in all its branches. They are pleasant to study, easy to understand, highly authoritative and thoroughly up to date. You will find

them a handy guide in your work in ready solution, for your problems and a dependable help to a better job and bigger pay Just read the list of titles and description and ask yourse f if you can afford to be without them. Then mail the coupon today?

Send No Money-Read Them 5 Days

It isn't necessary to send a cent in advance in order to get these eight big books and the Free Countiling Membership expiained in the panel. Just mail the special coupon. When the books arrive, deposit only \$3 with the postman and examine them 5 full days. If you are convinced they can help you, send in \$3 monthly for nine months; otherwise you may return them and get your money. Don't speculate as to "which job you will hold at 40"— mail the coupon today and let these famous books help you make a future in the electrical field. American Technical Society, Dept. 893, Chicago, U. S. A.

	rin i
CHARLES TO SERVICE STATE OF THE SERVICE STATE OF TH	
The state of the s	* * *
	픻
	Ą
	. 🚮
	1 211
Toght Hag	7 14 17
Fages their Promery  Local nations where Affrage	
the Bound Stamped in the bid and others for Bear H. Stamper A. L. runes for their jee a Unit. Man the course.	

#### SPECIAL 5 DAY EXAMINATION COUPON -

American Technical Society Dept. 593, Chicago, U.S.A.

I want to Leave more and Ears more Please send me postpaid, the end we mest of Aug and Frent may." I wan deposit at with the postmate in a given and. If decide to keep the broke, will send you all more by for a nemonate. There we may return them in Schars and get my more). I wanderstood the entoles me to a Free Constitute Membership in the Society, which I can use dody if I have

Name

Street

City

State

Employed by



### "There's one man we're going to keep"

"Ed Wilson, there, is one of the most ambitious men in the plant. I notice that he never fools away his spare time. He studies his International Correspondence Schools course every chance he

"It's boon the making of him too. He hasn't been here nearly so long as Tom Downey, who was Inid off yesterday, but he knows ten times as much about this busi-

"I'm going to give him Tom's job at a raise in salary. He's the kind of man we went around here."

HOW do you stand in your shop or office?

Are you an Ed Wilson or a Tom Downey? Are you going up? Or descut

No matter where you live, the Internstional Correspondence Schools will come to you. No matter what your handscape or how small your means, we have a plan to meet your elecumetances. No metter how limited your pravious education, the simplywritten, wonderfully-illustrated L C. S. textbooks make it easy to learn.

This is all we ask: Without cost, without obligating yourself in any way, put it up to us to prove how we can help you. Just coack and must thin coupon.

INTERNATIONAL COMPERCONDENCE SCHOOLS Ben 78-4 D. Germiten, Panne,

Without cout of obligations on my part, please tall up from 2 cars can life for he post-seed or in the author's before which I have been ked up X

#### SUBJECT TRAINING COURSES

Business Management | Kalenda anhip | Advantagement | India a Management | Advantagement | India a Management | India a Management | India and Ind

Miscinian Engineering
Cloudele Main of
Machinian Engineer
Machine Ship Penetics
Mathine Ship Penetics
Mathine Ship Penetics
Mathine Ship Penetics
Mathine Ship Machine
Mathine Data Mapping
Metallians Data Mapping
Herm Shiftmating Dange

TECHNICAL AND INDUSTRIAL COURSES As based's Blue Printe A S A STATE OF STREET Appendix of the control of the contr

Malini.	menenalist T	
Address.		3:6 34
City.	Binha	

Octupation. Private enviding in County about send that coupling to the Informational Correspondence Website transfers, Educated, Montreal, Canada

#### Mouny Making Opportunities

AGEN Y AND NACESSEY WANTED

\$10 to \$50 finity No. 10 temper. In the county from the first transmission to the Relations (American) for the No. 10 tempers to the first transmission, because the first property of the first transmission, because the first property of the first transmission of the first trans

The state of the state of the state in the state of the s

b b. Copy Das bun Migra be Representatives was not be be which it is a deep at 19 [197]. The Majoria of Paper agree thoole the charact of quantities at 1 grane of pase 2. Applied with a fine place to a 19 fine place to Applied with a fine place to the paper of the place of the

A with Household to work sells quarkly large print a september of the me Alig. Company. Dept. A. to that Mark the part of the set of

The property of the property o

| C | Control |

RELL Free! Merchanes from profit Deprophysy against passed to the later to a set of the set of the

Asserted New York A Section, Supering the many of Property Year part of the Language Country as the Section of the Section of

The second of th per 6 bermana 64

64 NEW 1 šп. mark or Bristott 1 = 10 1 = 10 San Lear

to provide the second field Souri Consenses with e langua at a man to a management to the

More Money Making Opportunities on pages 6 to 20

#### You too can make a week



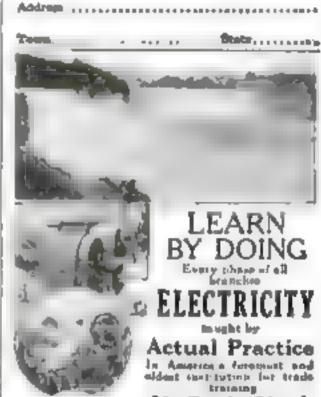
"I had no capraipor conselling by form do og with GOOD WEAR Now I make \$135 a week regularly I believe that any manistra il. secrit can do the

To earnest men every where we offer a wonderful opportunity taking orders for our fine, pure wood ruits and overcoats, regular \$55 values, all at the one low price of \$31.75. Our values are no remarkable they sell on sight, You get your remainment in advance, simply take the orders, and we deliver scaletollect. Our salesmen are making \$50 to \$125 a selesment over the over to \$135 a w even

No experience is needed and spare time will do. We teach and train you, sup-rly the finest selling outfit in America, big sell cloth semples and everything else you need all partied in a beautiful carrying case. If you want to viet every man who earrying case. If you want to earrying case. If you want to get into a high-case business, but job in write to make big money, and be independent, write for full information today. Address Dept. 175.

GOODWEAR Chicago, Inc. West Adams St. at Postia Chicago

Pirese send me complete (aformation about your Lur and the opportunity you offer.



No Books Used Individual Instruction Start Any Day Wide for FREE 64-page entaling THE NEW YORK ELECTRICAL SCHOOL 40 West 17th St. New York City. Open All Summer



المراهوا

And the College of th

the minister and work and country to grants 11 PDs groupstell, the bottom of the Post and country to grants 11 PDs groupstell, the bottom of the Post and grants 11 PDs groupstell, the bottom of the Post and the majoriter of the post to grants 12 PDs to grants 1

the or all the minute for two apolities and all fillings the or all the minute for the all the minute for the court of a during the minute for the minute fo

The both mentions applied to the mention of the both the second of the s

We design the land of the land

Notice to the speciment of the state of the

Part part all age power and a many that had a conserve has a many age of the serve and age of the serve a

Injury and the property of the control of the contr

the course of the party of the control of the party of the control of the control

Open had an approximate to the form of the property of the pro

The state of the personal of the state of th

More Money Making Opportunities on pages 6 to 20

### NERVE EXHAUSTION

#### How Nerve Abuse Wrecks Health

by PAUL you BOECKMANN

Lecturer and Author of numerous books and treatuses on Mental and Physical Energy, Respiration, Psychology and Nerve Culture

THERE is but one malady more terrillie than Nerve Exhaustion, and that is its kin Insanity. Only theme who have passed through a sege of Nerve I shaustoin can understand the true meaning of this statement at is HILL noother would can express it. At first, the victimes attain he will be and as it grips bem deeper he is a raid he as not die ist great. is his mental forture. He becomes panic stricken and irresoute. A suckening sensation of weakness and hespiesmess overstimes bon. He becomes obscured with the thought of self Sestraction

Nerve Exhaustion is due to nerve strain There is no other cause for it. In men, nerve exhaustion can generally be traced to excesses and vices, although the strain of intense concentration and the wormen of business life are often the chief factors, 18 women, Nerve Exhaustion is due mainly to over active emotions. Especially in their marital, domestic and kindred relations do women subject their emotions to constant upheavals, Indeed, we are all under severnerve strain because of the mor a minute life we are leaving. And no man or woman to a strong ast to immune to this strain.

Nerve Exhaustion is not a malady that comes suddenly, yet its symptoms are unmutakable. It does not manifest itself, as many think, is twitching muscles and trembing hands. The majority of sufferers from nerves seem strong and healthy, and may have not a tremor in their body, yet supportly their nerves are in a turmoil and are undermining the entire bodily organism.

The symprome of Norse Exhaustion yacs according to individual characteration, but the development is usually as follows: First wage lack of energy and underance; that total iss ing," Second Stage: Nervoument, restrongers aleeplessness, irritability, detime in sex force 1000 of hair nervous in e gestion sour standarb gas a house conelipation, irregular heart, poor memory, lack of mental endurance; dizanem; headache, backache: neuritis, rheumatism, and other pains. Third Staget Serious mental duturbances lear unitue worry; melancholus, dangerous organic dusturbances; stocidal tendencies; and in extreme cases, insanity.

if only a few of the symptoms mentioned apply to you, especially those indicating meatal turmoil, you may be sure that your nerves are at fault-that you have exhausted your Neise Freie

Pe ha was in have hased from ductor to to g the matter with you." Each doctor tells ties ha tare mosting be mader with high programme and the same history there is something the matter. You feel it, and I ware red digre cannot steen adment of great a age from a great and leave the he You are Cild viol are in n down and need a less hour days of the tired have run by Lowing him behind as that office a line

And don't be deserved rate believing that some mage evitem if physical exists in an rest go he nerves. It may develop a unmostle but it does so at the expense of the nerves as thousands of athletes have learned through bitter experience

The cure of weak and deranged nerver must



PAUL YOU BUIL KMANN

hather of News to a and mercus other had not at a, h. I' hidney Hern heng, H. a energed had d. a. shouly of h. h. h. has been consisted our torough languages

have for its basis an understanding of how the factors are affective as an examine of some and strains. It demands an understanding a ertain emister awarm men a and physical lighthem impates outful, fractation. After you to develop immunity to the many strains of es a to Through the application of this knowledge, the most advanced case of Nerve habitunition can be corrected.

I have made a life study of the mental and physical characteristics of nervous people, having treated more cases of "Nerves" during the past 25 years than any other man in the world (over 100,000 mass)

The result of this vast experience is em-hodied in a 64 page book, entitled "Nerve Force," a book that is essentially intended to teach how to care for the nerves and how to apply simple methods for their restantion. It includes important information on the application of deep breathing as a remobal Has kmarn Studie 164, 110 West 40 Bt.

the sek will enable you to diagrams your troubses understandingly. The facts presented will prove a revelation to you and the advice will be of meak mable value whether to a take and trouble with your netwes of mid. A six nerves are the most precious puror such some have. The gir them you ex-parament of his make life worth his on for his homeson make to be of historical, the number by his planes of his we. maracourage am a con and temperament The finer your brain is, the finer and more delicate is your nervous system, and the more anterstive it is that you care for your nerves.

Nerve Force" is not an advertisement of any treatment I may have to offer. This is proved by the fact that large corporations have bought and are buying this book from me by the hundreds and thousands for circulatted) which is there em dovern deflexency I've same resummend the land to their pane Ready Ministers recommend it Nover to the has so great a mass of valuable theoreta con been presented in as few words, It we enable you to understand your Nerves, year Man, your knotsons, and your Body the past fifteen years.





dental mechanic

WITH my training any good mechanic now earning less than \$30 a week can in 4 months become a Deutal Laboratory Expert and make from \$3 per hour up to \$10,000 per year! Every alet arrie-trained 'dental mechanic" will tell you there are more hig-pay jobs than experts to fill them. So I invite every aml, tious man regardless of age or education, to write for my sensational training offer man coupon for complete information or how you can prepare for salary of \$100 a week or more in double-quick time and at trifling cost.

Fascinating Mechanical Profes

70,000 Dentists in the U.S., but only 300 Laboratories to do their work. More Laboratories needed everywhere, more all round haperts trained as I wal train you, to muster every branch of Dental Mechanics -vulcanite plates, crowns, fixed and removable bruige-work, metal base dentures, paralle, removable bruiges, etc. Only

school on earth with ethical proclising Dentus supplying clinical and actual cases

#### Look How ! Help You!

I will make it worth your while to gight now to get really for the log opportunties in high-salaried positions, and to go into business for yourself in a good ecation Thils FALL.

R A Fare to Chica-

no of Detroit Fkb b Tools. Instruments and Suspher PRo & Free Doloma, Post Graduate Course and FREP Free Emple ment Bay read. We help you find while here (if des et ) an i help you see are a tigepay position when you graduate

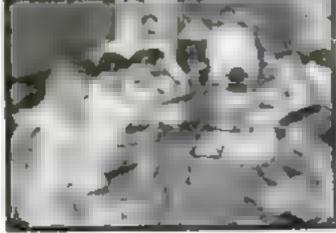
H. A. McCarrie, Director McCarrie School of Mechanical Dontistry Dept. 872-1, 1388 S. Michigan Ava., Chicago

Without obligation please send are your FRER. R. Pare offer your Free \$10 (sufficient and Free et along with complete offernation about how I may become a Deptal Laboratory Expert.

Address

City

State



#### Learn By Doing Actual Dentai Laboratory Johni

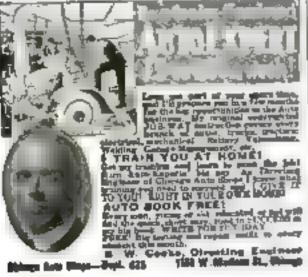
No classes or text-books. All edividual instruction with standard tasts, introduced and materials of Affiliation gas arterd Come to Chicago or Detroit where I have hull up and equipped the a gest Densai I abstratory schools to the world. Met are structured transferred by employers. My graduates are successful and I guarantee you

Tells you all about

FREEINEW BOOK Tells you all about the suspicious opporture les waitants
for you when you are a McCarese raised Dental
Laboratory Expert Espacion my faced practical
method of training you for him pay protection of the
open your own thousandy Contains my interest of FREE Raining Face and \$50 Gaths

Name memorability tight away! Write me personally right awayl H. A. MICARREL, Wireless

M-CARRIE SCHOOL OF MECHANICAL DENTISTRY 1236 S. Michigan Ava., Checago Dept. (62-L



## Why Good Dancers Are Popular CVERYONE admires and masts to to dance with the persons who have the fatest steps. There is no need of bring a walkere By my my remarkable new cast there is no the persons dance at home let a few seps method home set than them a pertonal trachet, No make or purtons at home to be a seps to be a sep to be a se

ny Making Opportunities

AGENTS AND SALESMEN

GPT into the tailoring game—one of the most profitable of all libes in the neiling field. Experience into the certainty and proper time with do. We sent you have to defined and such a first spilling bereiting to go out and make trum \$ 0 to \$20 a day from the very field day that spilling outfit is the fitable eries gotten translated and move make a00 table sample of peopl quality bright Wood Maltanan, make not begin pur own guellastry patterns. Also a big phopuling of high-class heavy-weight average tings. You do no delivering with our line, You just write you get them cash with order. I you want to get the tails and you get them cash with order. I you want to get the tails most profits the bosoness write his spillish Actives Dept. 178 Com. Which therein is no compact to the cash was content in your profits the finder. If our mind active they prove the spillish active make you get the region of the first your file of the real of the file of the continuence while the property of the region of the file of the real table to you. It also the file is you take to have some in your and the real file of the real table to you and the real table. Now you can have some in your a second of the file of the want of the profit of the property of the real table to be a supplier. As some that the to be a property of the profit o

#### DUSINESS OPPORTUNITIES

pristress of Portunities

[PATTY TA Persons of Trace Market Inspection A competence of experienced, prompt service for the protection of the log of the protection of the trace of the protection of the protectio

Ni M' plant, int' be savered al Operato a life repair shap Make of pentite in our leading. We start you do have complete equipments, then any those of tripes do not been lightened, additional Dainey Avenue,

I no is correspondence course hild, period qual oc-changed Limitre. (Control beight,) (no Mounthin, Progali Alah ma

Program Alath one programs of the board Destar Business bases a section between the board of the

1.5 A (C.) Come of the superior to the state of the state of the superior of t

Increased A Funk Correctioned. A New Probation, to the chief of the ch

CMI into transpose for yourself. Make tenney marketing projectory open in less under road open inhele. We byttplic avery time and show you have "limited from Michigalia, Brienish Lateratories, 224 Meserge, Infohmes, 3 lightes.

A Whiteless There is coming with digner and in-crease year regulations. The course it appears along the behalful, greated the party for company 432 Philippy with the

(APPRATE DY meets and impulse inches these water see not \$1.50 and \$3 days. Sond for sample of the Narotralia til.

Keep pour present tob um Witte Lean Lander! (7-1) Viduets Witte Kannes

where the NA 'a." Merculus Remains Month make mouses and get field. Beautiful multipe from horself to 4.75 are \$2.000 for bill partholide about horself to distribute mississa. Plant for calange. Moste-Mode" [thing De Sea, Laport Multigan.

BE a manufacturer Own your own business. We read you and burnish everything. Business position because demand. Proc booklet. Men and women write tuday. Dopt ES. No. 50. New Orleans. La.

pless makes prois on mail projet adversey highliness and mail tag can make \$60 weekly part time required every lang supplied; bank telestables, historical free safe per and pook Morvel Co. 2002 Market, Palladelphia, Pa.

( MAIDE Still 100 As from Canado Specialist Front Committee to Maide Advertisin Builder Leept A 349, 1133 Boundway, New York

ALLNUT COPPIER your two Beauty Clay Send 8: 00 he origins \$50.00 factable. Valley Laboratories, Wilmording Penna.

PATEN'S applications filed guarantee priority \$20; drawing deferred \$1.0 twice all unineers, unic projec-tion. Investors Service at President N 3

WHY work for somewhot Mart a bouldess \$100 perfected. Information, Intel H. Paul Raye, 149 B. way N 3

MIL ATTEMPISER Ast to-day for a copy of MR ANYPHITISTER AS IN-day for a copy of "Querk a me Admenting Rate Folice" if training more really important facts which will prove interest and explanate facts which will prove interest. Propries Science Monthly Profit sidy 1 out fills a an weather 1 out Manager Charles Advertising Papel Science Monthly 250 Fourth Avenue New York

More Money Making Opportunities on pages 6 to 29



-The Book that is Showing Thousands the Way to Big Money in ELECTRICITY

Establish yourself as an Electrical Expert Find out how the Yew Shop Type training fits Thousands are you at home in a few weeks. taking the chart cut to begger positions. Remarkable method guaranteed by famous Lauren literature of Technology Least all branches without previous experience. Free Employment—un in ten advice—legal binding guarantee of an advituin or money back Write as once for information about complete Electrical appointing and instruments given. Also big new book. No obligation.

S. & H. ENGINEERING COMPANY Afthoral with the Lincoln Institute of Technology 1422 W Monroe St. Dopt L-16 Chicago, IR.

Just Out

13th Edition

A NEW AND GREATER

#### Dyke's Automobile Encyclopedia

Entirely Revolution, Reservinged and Plantrateds. Creatly Enlarged, 1350 Pages, 6145 Marcottoms. A Practical Book for Everybody



The Repulsman will The Repulled will dead a said at adjust a said at adjust a said at adjust a said at a ever mini repairmen.

This Book Will Touch You to Become

An Expert tetamen-blic Reps cream. But only on the right ad-parition and expets and empty of the bu-tore expense hard from etc. Triagromera, and transite with the

Don't with Grater Name? Ciuth 66.80- Liney American Morocco 87.80 Proceeds

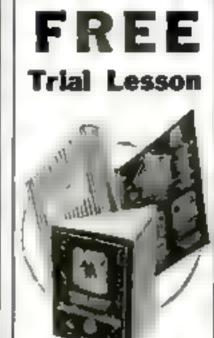
Popular Science Monthly 250 Fourth Ave., New York City

### The Vest Pocket Bookkeeper

A sample and concise method of practical bookseeing, with short cuts in figures and complete instructions for the correct keeping of books of accounts. A working model adapted to the novice and business man is included

Price \$1.00, postpaid

POPULAR SCIENCE MONTHLY 250 Fourth Avenue. New York, N. Y.



This femon in Drafting is sent from input required lawers from P = well questioned you gar for this profession for alma have Chicago Tech given expect trusting by mail.

While other schools require entull went and my herit of som to ud bales. Charage Tech armia than leaten first. Just mad the company



Use hours that you now have idle to get in training that will double your income. By utilizing a little of your soure time under the direction of the Chicago Tech, experts, you can become a master Draftsman—

you can command a high salary and hold an important position. No need to stay in a "blind alley" job, no need to wait years for real success when you can so ensity seculive a profession which will put you among the mea. for whom great opportunities are always open.

#### Double Your Earnings

There are not enough really able Draftsmen to supply the demand. Great industries everywhere are searching for men who have the training to handle the important problems which must be worked out practically and accurately—and the men who can do this work can name their own salaries. Don't put of a day-start now to get this Chicago Tech, training which gives you the abort out to a larger income.

#### Get Practical Men Back of You

Chicago Tech, experts teach you the peac-

Salary Increased were thing T E Inderson Income Joon fore I en Ged Soccessful in own Comment Section T II. P. PS

To Employeest Chicago Tech, men-

to us whele you need.

total parthods which enable you to take a job key wind suel what or do and how to de at Nomen Paris it on e n den a un h actual probderes permitted necession of these exacts at every et p. All his you get by mail is pour space time

#### Chicago Toch. Mon Always in Demand

Except there you find through the man promportum you take drawing bigh manner because he base the year hereages for higher the proceeding land in the higher testings had marked there were horsened to rail readly, marked to a rail readly, marked to a, and the testing of the higher and the highest rail readly at last testing and the highest rail results.

Encoded in his Nude Contemporary Description The fit from te all perce 



#### Send the Coupon

Get the Few Trial I came and information about the this ago Tech Method of training D of ing by mall, First put about the opportunities than Drafting offers to you. Mad the compositoday 

CHICAGO TECHNICAL COLLEGE Dept 931 Chicago Tech Bidg 210 Reet 49th Street, Chicago, III.

We have read of abliquities on me, plane and in-structive as many or about appearingships in the Lines.

\*\* Deafting. 17the Big Supery Course)

No experience mercenary: Free Lances pend new,

\* Building Tende Course

For men in the building times.

Write or print name plately

Name.			++ + +	****
Address.	** *			
City		State,		****

### 



PAID VACATIONS

pp lang-10M / Address.....

\$1600 to \$2300 Year MEN-BOYS 17 OR OVER SHOULD MAIL COUPON IMMEDIATELY

Franklin Institute, Days, Mt 277, Rashester, N. T. Stra Send he without there I sample Rallway Mant Seck Farming 100 questions A tell or laws to get a a 5 5 overhoost too A send the of places of which reasonaters will be held I wind copy of Bushrand book. How to Get Government John.

Mana.



### \$95 an Hour!

"Every hour I spent on my I. C. S. Course has been worth \$95 to me! My position, my \$5000 a year income, my home, my family's happiness—I owe it all to my spare-time training with the International Correspondence Schools!"

Every mail brings letters from some of the thousands of L. C. S. students tell ing of premotions or increases in salary as the rewards of spare-time study.

What are you doing with the hours after support Can you afford to let them slip by unimproved when you can easily make them mean so much? One hour a day apent with the L C. S. will prepare you for the position you want in the work you like best.

Yee, it will Thomsands have proved \$1. For 02 years, mon in offices, stores, shape facturies, in new, ra irondo- a every line of technical and commerdist work have been winning promotion and in-greated salaries through the I.C.B. More than 198,000 men and women are getting ready each wow with I.C.B. help for the bigger jobe sheed.

#### Your Chance to Hure!

No matter where you live, the J. C. S. will some to you. No matter what your handleage, or how small your means, we have a plan to best your accuration. No matter has limited your press as adors for, the simply writing wonderfully illustration, trafed I C S. textbooks make it may to lours. No matter what calver you climes, some one of the \$90 I. C. S. Courses will surely sait your made.

When everything has been made ever for you-when one hear a day arent with the J. C. S. in the quiet of your own home will bring you a burger increase, more constitute, more pleasures, all that success means—an you let and her ample price-less hour of spare I me go to wants? Make prior start right near? This is all we sale. Without cost, without bright prior to be any way put it up to us to prior how we can help you. Just mark and me. This coupon. gad me his coupen.

Without med or obligation or in the publish before the first the problem of the problem of the publish a first before the first the publish before the first the publish before the first the first the publish before the first t

#### BURINESS TRAINING COURSES.

Parlinger Management

It is no for an interest the manual transfer at the first and first transfer at the first tran To the second and Armendaling

It the second and Armendaling

It the second and Armendaling

It the second armendaling

Proceeding

Specials

Officers

Adult

TECHNICAL AND IMPORTRIAL COURSES

TECHNICAL AND ME
TRICK TEACHER
To the Sage in a care of the sage of the sa

the test the Prime to the test to the test

Feme.	 			 	
Address	 		-	 3 -6	24
Chu_	 	James		 	_

Personal revolutes in Counts should need this remove to it fattered that appropriation debath Counting, Louising Montreal, County

#### Money Making Opportunities

#### BUSINESS OFFORTUNITIES

STURY Man Order Standards Practical Information resourcing in workerful apparaturation of administration of admini

Beneficial from Maria Orches Serve and Derman Body

A R \$10 fth ow I write there exists remained in the

Edited and in property Seat regard being as transformed.

Edited and of provide all representation to the particular of provide and order by well as one of the particular and order by well as one of the particular and the particula

will by he will see he have a passe have to make the more of the third that the modern before are an excellent themselves are an excellent themselves are an excellent themselves are a state of the transfer of the transfer

#### STAMPS AND COINS

PORPHY Strang to any min for Cornel Comparty to the arm of the process of the party of the party

The Non-response Approved Columns States Co.,
Non-response Approved Columns States Co.,
Non-response to the states to be contained for the first to the states of the states to the states of the stat

of the published stances been to proje to approved the transfer to be the best to

The probability of any power to proper a appropriate the probability of the probability o

43 or freeze to the entire property, hereton, Win.

The property of the part of \$2 different or the straight beam of the harm \$2.00 t. F. Het mill-har to be to perfor to give and rules by early be T. in a pour offer or the appropriate I missing from property the part of the property that the straight of the straight of the property that the straight of the straight of

The Falve Shows Started Free Colorater in-duce our fire of of test at all Approximate Propaga-te Physicians e. 965 but a letter, Los Angeles, Calif-

have the house of the state of the second section in affective to be stated appropriate absential and supply provided appropriate appropriate and supply of the state appropriate and supply of the state appropriate a 1 1 C 25.58

WITE CHRISTON 30 Inferent 15e Browns S ALLEGE MAN

is \$17.5 It foreign or \$0.57 % such different to

STRANSPORTED TO SUSSEEN SE SECTION SOO MINISTRALIA Belliant Ma 100 4.4 Roston

THE CONFIDENCE LANGE TO A SUPERIOR OF THE CONFIDENCE OF THE CONFID Science Monthly 250 Fourth Avenue

More Money Making Opportunities un puger 6 to 18



Meyer Both Company the largest Commercial Art Organization in the World offers you a practical training. based upon twenty-five years of success. This nationally known organization each year produces and sells to advertisers ever 15 000 commercial drawings. This well paid profession equally open to teen and women. Flome study matruction.

Get Facts Before You Enroll in Any School Ask the Advertising Manager of the leading newspapers in your city, about Mayer Soth Company—for them sall you about us. Send last south in stamps for about said book telling of the success of our students,

#### MEYER BOTH COMPANY

CHICAGO (C) Rets-To Art and Engravant Finne: Spring

arbeite among and graduates, freite man

Get at the Automobile Bus been the w ford Cora of the st Single

a success of the sent Thomas of apporting a success of the sent of

Earn \$2000 to \$10,000 Yearly Fits programble that a new few helds in higger pany. A substitution and in the set of the state of the set of

MICHIGAN STATE AUTOMOBILE SCHOOL HIS Auto Strig., Svirott (The Auto Conter)

#### ARITHMETIC OF ELECTRICITY

A practical treature on electrical calculate as if a 4 day age to a series of rates all of a & da ucc to a terres of rape all of the aim of the aim of the aim. erdinary entitimetic. 200 pp. Price, \$1.50.

POPULAR SCIENCE MONTHLY 250 Fourth Avenue II **NEW YORK** 

Learn Carteoning At House- In Your Spore Time

from the influent than how turned on (remember to the set of a fine to a page or only in the set of the



### \*5000 AUTO EXPERT - YOU CAN BE A

there is the systematic way as his paper were. Taken mere as hower a very former space a love for a love mountles. In this case, properly from \$2.00 is something the state of the state of

A. B. SAVETON, STORE, CHICAGO AUTOMOTIVE INSTITUTES.

Attend a School Operated by Build- ( mag Constructions. Three Months Day Course \$75.86. ASSOCIATED BUILDING EMPLOYERS 1200 A. R. E. Building, Grand Rapole, Mich. Bricklayer



#### Learn CARTOONING Emay vo at Home in Spare Time

Regardless of how attle you know about cartooning new you can easily quantly for a poto ion in this attractive, begin attoried business. This home-stony method starts you at the simplest formattiontal principles of cartoonmaking and takes you through every branch of humorous and serious artooning. You will be amade at low quick you teacher you to draw smalle work. Many andents of this method began to sell their framings before they were half through their courses. The training paid for itself long before they finished it.

Learn carmon ag thu easy way. From the fascinging are of a successful cartoonist casy hours, freedom from robtine your own bons, and \$3 000 to \$15,000 a year for this work that AL PHAY

#### Send for FREE BOOK

Learn more about the wooderful opportunities

in tashniping, and artalla no ht the rend ha homestery period to home supply nations, bushed has not be throught which are the parts who he sent to you with at the six to eat obligate in. This which go broadet gives a horse hors training field and gragita na in leta dibia mondere dinem prethod af denchina flar in its me Send for et today!



#### WASHINGTON SCHOOL OF CARTOONING Room 249, 1113-19th St. M. W., Washington, D. C.

WASHINGTON SCHOOL OF CARTOONING.
Room 10, 1111-13th 21. N.W., Washington, D. C.
-fram send me, wallest children, and Feet Brokket
on fact sends and full details of your home study method
of verbiling Cartesman.

ton. Name Painty)

Adaptes.

City.

off under to please give age

#### LEARN ENGINEERING

Greek Depart for Practical Technical Engineers, Big Falaries. Wangerid Previousness Thomaside of our placement holding may on be highest and peal one. Practical Technical Lagrest and Mention of Practical First close out Mentionizal Lagrestage Mention of Con-densed Method Facilities Facility of Lagrant Present Technical First day and Mexiconical Languering Mergle and Los General Stephen and Los General Languering Mergle and Los General Languering Lan

## its (ause and Gire "

to can be colorly cured. Scal to cents for 112 at this beam beam on taking an and for call. Station on a 50 es a succession of consult.

grae Barilding, 1147 M. Itt. 51, Indianagetis.



### \$2,500 Reward For the Capture of An Unknown Man

TAWICE he had entered the St. Clair Manmon. What was he after? Who? What was in danger?

Berteau, the femous detective had warned St. Clair that the saysterious mercuder would come again. And now-a noise in the passaget The creak of an opening door. A shot in the dark! A capture!

is this wounded stranger the mysterious intruder? Who could tall? Yet Berteau identified the man without beutation and won the \$2500 reward.

How did he do it? Easy enough for the Finger Print Expert. He is the specialisis the leader, the cream of de-tectives. Every day's paper tells their wonderful exploits in solving mysterious crimes and convicting dangerous criminals.

#### More Trained Men Needed

The demand for trained mea by governments, states, cities, detective agreems, corporations, and private bureaus is becoming greater every day. Here is a real opportunity for YOU Can you imagine a more fascinating line of work than their Often life and death depend, upon finger print evidence - and big rewards go to the expert. Many experts earn regularly go to the expert. Many expert. from \$3,000 to \$10,000 per year.

#### Learn at Home in Spare Time

And now you can learn the secrets of this ectence at home in your spare time. Any man with common actual education and average ability can become a Pinger Print Detective in surpristagly short time.

#### Free Course in Secret Service

For a limited time we are making a special offer of a Preferanceal Finger Print Out it, absorbed by free, and Pres Course to Acres Jarvice Intelligence. Mastery of these two hindred professions will open a brilliani carrer for you. Write quickly for fully illustrated free book on Pinger Prints which explains this wooderful training in detail.

Don't welt until this offer has expired — mail the coupen now. You may never see the an-couperment again! You assume no obliga-tion, you have recrything to get and nothing to loss. Write at once — address.

University of applied science Dopt. I.I-44 [930 Sensyside Ave., Chicago

University of Applied Science, Dept. 11-64 1928 Sunsyside Avenue, Calcugs, Elles	_
1928 Sunsyside Avenue, Calcugs, Ellee	h
Gustlemen: Without any shillenting whatever and a	d
year are fully illustrated, FitEE book on Fings	넌
Continues: Without any unique; so whatever and a year new fully illustrated, FilEE book on Fing Prints and year offer of a FREE square in Borr Sepring Lethinguage and the Pres Productions of Pres	*
Print Outlit,	

/	

Our "April nuclearing Control of a ping highly receiving method which elic in a real man on work with the year stay occupied and year are been fixted for and quiete year stay by why an " y a real world like the best been highly been stay by the control of the ping of Vacational Research. "X-9 housing the test







# Radiotrons WD-11 and WD-12 Made History

It into a proving WD-13 tables in a Redistron.

le inc'i a genuine WD-13 unice ic'e a Radiotros.

Icharit a proutee UV-198 union die a Radiotron.

Ir les en provinc DV-200 union is a planting

Itina's a generalize LIV-101-a.



You Can Change Your Set to Dry Battery Operation.

If your radio set it equipped with nave type tube sockets, you can hange to dry hatrory operation by interting WP. 2 Radiotrons. Ask your dealer for information as to how this can be dead.

These are dry cell tubes—the tubes that made possible the swift progress of radio in the home everywhere. They meant clear tone—undistorted detection—radio and audio amplification—and volume reproduction—all with dry batteries. They meant radio in the city—on the farm—off in camp—everywhere!

And to-day, there are millions of these popular Radiotrons in use. Today everybody knows them familiarly as "WD-11's"

and "WD-12's." But they are not genuine unless they are RADIOTRONS.

Always be sure to look for that mark on the base, and for the RCA mark on the glass. It's important, whether you are buying a new set with the Radiotrons in it, or buying new Radiotrons to replace old ones. Always look for the Radiotron mark and the RCA mark. Then you have the genuine — sure to live longest — serve best.

Radio Corporation of America

Sales Officer Depr. 319



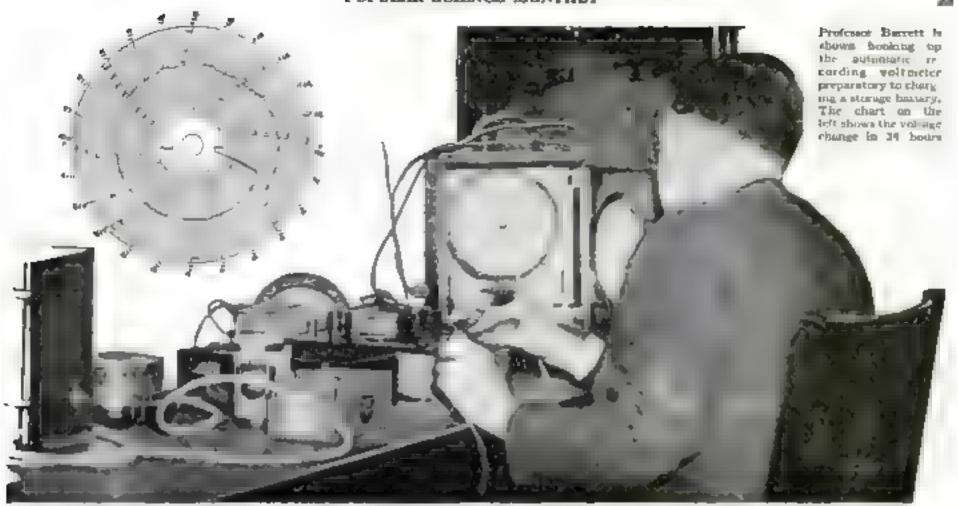
233 Broadway, NewYork

10 to, Lafelle St., Chicago, Mi.

433 Cultivarie St., San Francisco, Cal.



# Radiotron



### Testing Radio Storage Batteries

By Prof. Sampson K. Barrett

Engineer in charge of battery testing Popular Science Institute of Standards

PROBABLY no piece of radio equipment has its vital parts more completely hidden than a storage hattery. In looks, there is no appreciable difference between a 10- and a five-dollar battery. The difference is in the plates, and there is but a small hole through which to examine them. The engineers of the Popular Science Institute of Standards examine these plates by observing the functioning of a battery during charging and discharging.

Three things must be investigated to determine the value of a battery the ampere-hour rating, the life in cycles, the

ability to retain a charge.

After a thorough inspection, the specific gravity of the electrolyte in the cells is measured. Presumably, when bought, a battery should be in a state of charge, it must be remembered that all manufacturers do not charge their batteries with an electrolyte of the same specific gravity. Many batteries are completely charged when the hydrometer reads 1.200; others run as high as 1.500. In general, one will find batteries completely charged at 1.275. Our engineers compare the figures obtained on this specific gravity test with the claims of the manufacturer to determine the state of charge

Then the battery is discharged by utilizing load rheostats until it reads 54 volta—for a six-volt battery. The specific

from which to start the test.

gravity is read and that becomes the lower discharge limit. The battery is again charged and readings are taken at intervals to determine the number of ampere hours required to return the battery to its maximum charged condition. When the voltage ceases to rise, the battery is considered charged and specific gravity is again measured. This determines the upper range of specific gravity for this type of battery and that is compared with the manufacturer's claim.

Once more the battery is discharged and the ratio of ampere hours taken out

of the battery to those previously put in when the battery was charged gives its chiciency, which should range from 85 to 85 per cent. Batteries increase in efficiency for the first few cycles, usually arriving at the maximum at the seventh cycle. If a radio battery is less than 80 per cent efficient at the fiftieth cycle, the institute of Standards disapproves it.

Probably the thing that interests radio fans most in a storage battery is its ability to retain a charge. After the above tests.

Probably the thing that interests radio fars most in a storage battery is its ability to retain a charge. After the above tests, the battery is charged and allowed to stand idle, being tested every few days. The minimum requirement is that a battery shall not exceed two per cent of self-discharge every day. A good battery will still show 80 per cent of its initial capacity after three months.

It is obvious that a battery standing up under the severe tests detailed above must give estafaction. A purchaser will do well to use batteries approved by the institute of Standards.

It is obviously impractical for even as completely organized a bureau as the festitute of Standards to test all products listed in tool or radio entalogues advertised in our columns. Only tool and radio products specifically advertised in Popular Science Monthly are tested and approved by the Institute.

#### Send for list of Approved Products

POPULAR SCIENCE MONTHLY will be glad to furnish, upon request, a list of Radio and Tool Manufacturers whose products have been tested and approved by the Institute.

## POPULAR SCIENCE Monthly

Guarantee

The above seal on an advertisement indicates that the products referred to have been approved after test by the Popular Science Institute of Standards.

Popular Science Monthly guarantees every article of merchandise advertised in its columns. Readers who hay products advertised in Popular Science Monthly may expect that these products will give absolute attisfaction under normal and proper use. Our readers in buying these products are guaranteed this satisfaction by Popular Science Monthly.

THE PUBLISHERS.





TRADE MARK

WHEN the archer minds the center of the target he seeks for the cause of his failure within houself."

-Confucius

The man who owns a Grebe Receiver seldom misses, for the Tangent Wheel Vernier enables him to acquire extreme accuracy in tuning.

4 motor Illy

4[]4

Grebe Repenerative Receivers are licensed under Armetrong U.S. Par. No. 1 113,149, Oct. 6, 1914

## A Device found only

REBE

Receivers



### The Grebe Tangent Wheel Vernier

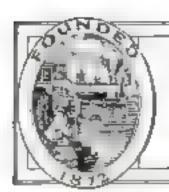
To have once experienced the ease with which you can tune in stations on a Grebe Receiver, is to know the value of the Tangent Wheel Vernier.

The keenest appreciation comes, however, when you find yourself instinctively reaching for this ingenious little device below each of the tuning dials on some neighbor's receiver.

This and many other details of Grebe craftsmanship are fully covered by patents granted and pending. These details are sought by the man who looks inside of the cabinet.

Let us tell you more about Grebe Receivers

A. H. GREBE & CO., INC. Van Wyck Blvd. • Richmond Hill, N.Y. Western Bronch: 451 E. 3rd St., Los Augeles, Cal



### POPULAR SCIENCE MONTHLY

SUMNER N. BLOSSOM, Editor

September, 1924





### If the Exploding Mira Ceti Were Our Sun

By Scriven Bolton, F.R.A.S.

TUPPOSE our earth, instead of being governed by the sun, were a planet of a giant exploding star that, in occasional gruptions, threw out 20 times as much beat as the sun. What would happen to us?

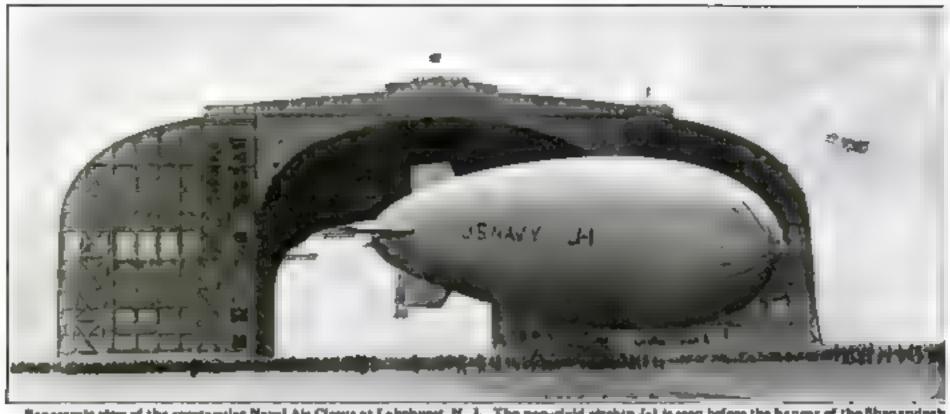
I have drawn here an imaginative picture of how our world might appear under such conditions. It was suggested by a recent mysterious revival in the brightness of the great dying red star

Mira Ceti, in the constellation Whale One explanation of this brightness is that a crust is beginning to form on the surface of the star as it cools. Pressure becomes so great that violent explosions frequently occur, and the light and heat emitted is increased many times.

Mara Ceti is dying down rapidly, and now is not as hot as the sun. Yet it is so vastly superior in size that if we were as near to it as we are to the sun, our globe would be a red-hot, lifeless mass, without atmosphere of oceans.

The heat emitted by the star after every explosion would approximate 1000° F. at the earth's surface. Metals with comparatively low melting points, such as tin, lead, and bronze, would flow like water The terrible bombardment of poisonous games would make life impossible

Mira Ceti is a star of the older type. It appears to have a gaseo-liquid interior, not wholly gaseous, as the younger suns. The spectroscope tells us that its atmuspheric layers are composed chiefly of hydrogen and titanium oxide.



Panaramie view of the questionaler Naval Air Closus at Labeburet, N. J. The man-right strakes J-1 is seen before the hanger of the Shunandock

## Sky Sports of Tomorrow

By Lieut.-Comm. Fitzhugh Green, U.S.N.

THLETIC contests and other forms of sport are being literally crowded off the earth.

Last year 303,430 people attended the World's Series. Football stadiums holding 100,000 spectators are being built in vari-

ous parts of the country. Larger swimming beaches, larger gymnadums, more numerous golf links and tennis courts are being nut into communion as repidly as money and labor are available.

But the crowding always seems to be just shead of the building. It is practically imposalbie to attend a modorn contest that has been widely advertised without a disagreeable preliminary battle for parking space and tickets.

A fascinuting solu-

tion of this vital national problem is suggested by the sudden entrance of aeronautics this year into the field of eafe and pane aports and pastimes.

This development is coming from two directions: first, the "buby balloon" used as a sort of life-preserver to carry its wearer into the free and uncrowded sky; and second, the commercial dirigible reduced to taid size for family use. Both types have been studied at our naval air

base at Lakehurst, N J., and at Mitchel

Field, L. L. of the United States Army The first signs of this novel outgrowth from military aviation came in the form of "dog-fighting," "bubble-chasing," and "aerial tag." A "dog fight" with planes was simply a mock duel between two highspeed combat machines thrillingly maneuvered by stunt fliers. Lieutenant A. L. Williams, the pavy pilot, who won the Pulitzer Prize last year with a speed of 266 miles an hour, probably is the world's best

"sky terrier." "Aerial tag" is another form of this pursuit game, and is played according to special rules that determine when each pilot shall be the pursuer or the pursued.

"Bubble chaming" in still another spec-

For instance, it was soon seen that both in dog fights and in bubble chases a crowd would be even more enthusiastic if alow planes were used rather than racers driven by notorious speed demons. Skill and agility in air maneuvers proved, in the

> long run, more alluring to human interest than hair - raising stunts, which soon palled after the first excitement had wors off. As a result, the percentage of accidente in such entertainmenta soon was reduced to almost zero.

FROM this form of serial sport the next step was a logical one. When it was seen that people wanted competation between the entries, combined with safety of the entrants, "parachute racing" was



chuntum. one of the mort Untilling of the exclient, air aporte

> small free ballooms of various colors are released. Each pilot in the air chases his own color, seeking to destroy the drifting bright-hued rubber bubbles by diving into them with his whirring propeller blades.

> OF COURSE such performances are replete with thrills. They represent the most blood-chilling form of serial acrobatics. The men engaged in them risk their lives every moment of the game

> But, to the surprise of the authorities, the popularity of all these serial demonstrations seemed to center not on the dangers that beset the intropid birdmen, but upon the spirit of competition involved. Acting on this cue, our experts at once began developing an entirely new technique. Projected into the future, the novel forms of flying they have achieved may revolutionize our modern ideas of sports and athletic contests.



er in by a ving into-

them with the plane

The shaded areas indicate the most important belium deposits as the United States, the world's greatest producer of this safety gas for airthips. The straight lines indicate less important deposits. The map was made for this magnitude by R. B. Moore, D.Sc. former chef chemist, U. S. Burseu of Minas

tacular game with planes. A number of



Beyond the great proud of spectators, is the giant cary dirigible Shonandoah at her mooring-most. At right is a jumping balloon

devised. Several parachute jumpers were sent up in alow planes or captive balloons. At a given signal all dropped at cace.

OF COURSE, in this form of contest the speed of falling is beyond control of the lumper unless he is given control of his parachute's apox vent. But this dangerous expedient is rarely resorted to save in an emergency, such as when approaching open water. So the result of a parachute race is left to the caprice of local meteorological conditions. Vertical currents of air are the determining factors. By having colored parachutes or distinctive suits for the airmen, their performances can be wagered upon just as if they were lockeys.

But the parachute game ham't met with any wide enthusiasm, chiefly because it lacks the element of human competition based on man's individual effort. Hence, this summer the "jumping balloon" was

brought into favor.

As was suggested above, the principle of a jumping or baby balloon is similar to that of a life-preserver. But with air as the swimming medium it is necessary to add relatively more buoyancy to the swimmer than in water. The reason is that the weight of air displaced by one's body is far less than that of the same volume of water

The jumping halloon is just a small

A believe jump over the She and on a hanger is said to be possible. Compare this with the record running bread jump





Taking off with a jumping ballom for a "seem" through the ar. The buby believes in strapped comfortably to the jumper's back

the back with broad

bands running under

the armpute and chest.

course, that a negative

to buoyancy always

exists or the jumper is

in danger of helplessly

leaving terra firms for a

It is necessary, of

25 FT 3 PR

haphagard ride of unknown distance in the air. But with only a few ounces of negative buoyancy a man can perform astonishing fests.

Take the athlete who can jump, my, 24 feet. By reducing his weight 1000 times or so, theoretically be could jump about half a mile! As a matter of reality, though, he would find that the awkward size of his "air preserver" would prevent his getting any sort of take-off. Yet one of the navy gang at Lakehuret has vowed that before he leaves the station he will, by this means, jump over the huge hangar of the dirigible Shenondook, which is 348 feet wide and 200 feet high!

It is at this point that we enter the broad realm of future air sports. For if one's body can be made as light as a feather, one may jump and swim and float in the air as we now do in the sea.

Certainly there is need for comething of the sort. Take conditions at Coney Island. Of course that resort is near a big city and is more crowded than most beaches. But many others will soon be as congested. Not so long ago a man who was toppled over by a big wave knocked two teeth out by striking a stranger's knes on one side of him, while his flying heel delivered a French Kayo to an unsuspecting lady on the other. Obviously, there simply wasn't room to swim, Whereas had the same Sunday multitude been cavorting above the ocean at that point, there would have been comfortable space for a thousand times the same number of holidayites.

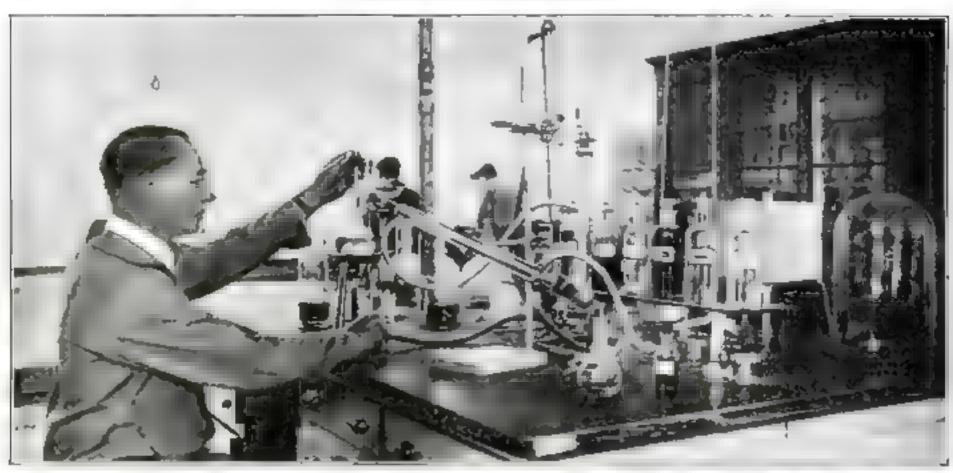
"AIR beaches" soon will be a reality. The akies above large city parks would provide areas. Of course, "life lines" will have to be strong. On an orean beach there are buoyed ropes. On an air beach there will be light note dangling from captive balloons so that the air swimmer will not be blown adrift across the city

The expense will not be very great. Balloons will be hired, fitted, and worn as roller skates or bathing-mits are now And, best of all, no risks will be taken. The balloon will be locked on by an attendant so that the wearer cannot escape even if he should try

Another form of air sport is rapidly evolving from the taxi etyle of dirigible. The French recently have designed and built what they call the "Vedette." This is an airship that has the same relation to big fellows like the ZR-1 as a trim road-ster has to a bulky truck.

(Continued on page 125,

sphere containing belium or some other gas considerably lighter than air. Helium is particularly convenient because it is non-finameable, and so permits the "swimmer" to smoke if he or she desires. The halloon is strapped comfortably on



Mr. Gardeer in his laboratory, where every kind of point and special is subjected to the severest releatible tasts

### What Paint Means in Your Life

An interview with Henry A. Gardner, Director of the Institute of Paint and Varnish Research at Washington

FILE touring New England recently I came upon a tumbledown barn, its roof bollow and broken, siding ragged, and its mighty beams away and crumbling. Neighborn testified that it had never seen paint

Just beyond was a barn a hundred years older that still stood square and unbroken. It had outlived successive owners, and the secret of its longevity was simply paint

and more point.

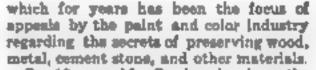
But the secret of paint is another story. In fact, paint has innumerable secrets, many still unlocked. Within the last decade or two, scientists have been searching chemistry for the keys to paint mysteries, and have opened the doors into paint and varnish knowledge that previously were quite unsuspected. The scope of the preservative art has been extended in a hundred directions. In the days when those New England barns were built,

those New England barns were built, paint was just paint. Its alchemy lay deeply concealed under a hurden of ig-

horance.

Today the paint put on a barn would not be used on the deck of a ship; and the paint on the deck would be of no value on the ship's bottom. Nor would the paint on the ship's bottom be of use in painting an acid-manufacturing plant. We might go on with these comparisons, and only touch the high lights of paint research.

Indeed, research has thrown the searchlight into tunnels of paint usage lutherto undreamed of. It was never known, for instance, that paint might have a pronounced effect on acoustics, human growth, and plant life. Nor was it realized that the color of paint could affect materially the radiation from a steamheating plant or the evaporation from a tank of naphtha or gasoline. By Edward Mott Woolley



For 15 years Mr. Gardner has been the genius of the paint industry, which stands back of this research organization. I found,

near the War Department, a paint laboratory of extensive ramifications. There were optical and other physical instruments and devices highly scientific, a minister paint, color, and varnish factory, and numerous rooms tilled with chemical paraphernalis.

With the pneumatic sprayer one mannew can do the work of five using the band brush. Below: Tests showing effects of turedo no wood uncosted and costed with esperimental paints and submarged six sounths in ocean. Unpainted plants are badly pitted.



Ever since large chemical factories came into existence, the bane of the adjacent bouse-owner has been the discoloration of the paint on his borne—for which there seemed no remedy.

Retarding the work of fire, branding cattle, disinfecting, fighting off the barnacle and toredo in salt water—these now are the duties of paint. Paint research has set in motion new industries that concern not only pigments and chemicals, but horticultural activities as well.

To get the emence of the progress I went to Washington and talked with Henry A. Gardner at the Institute of Paint and Varnah Research,



euch as colorimeters, refractometers, spectrophotometers, and viscometers. There were rabbits and guines pigs for physiological and psychological tests of colors, and no end of mechanisms and methods for testing the performance of paint materials.

"I FOUND, however, that the laboratory was merely the pivot on which revolved activities extending over the continent and beyond—on the land, underground, and in the water. Few consumers of colors, paints, and varnishes know what the scientists are doing to improve these products and to find new paints and varnishes for checking the ravages of nature. The paint scientist must have at least a working knowledge, not only of chemistry but of bacteriology, biology, botany, physics, pathology, and other sciences, for all these have been applied to problems confronting the industry.

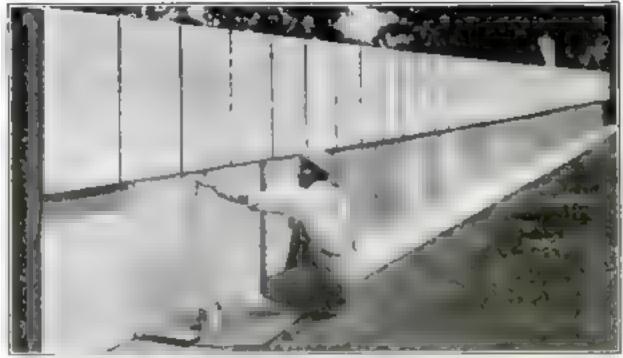
"In recent years especially," said Mr. Gardner, "the paint chemist has made many discoveries to extend the use of preservative coatings. New pigments and colors are now in use, helping to meet the demand for paints, thus taking some of the burden from white lend. That these developments are necessary is indicated by the fact that demands on the metal lead may make the supply for

paint insufficient.

"Whenever a need for a new paint has manifested itself, the chemist used his imagination, first to conceive the possibility of such a paint, and then through amentific research

to develop it.

"Fifteen years ago scarcely a dozen paint factories had chemiats. Now practically all of our 300-odd manufacturing plants use them. One factory alone has more than 80 technically trained men in the laboratories and plant. In the last 10 years

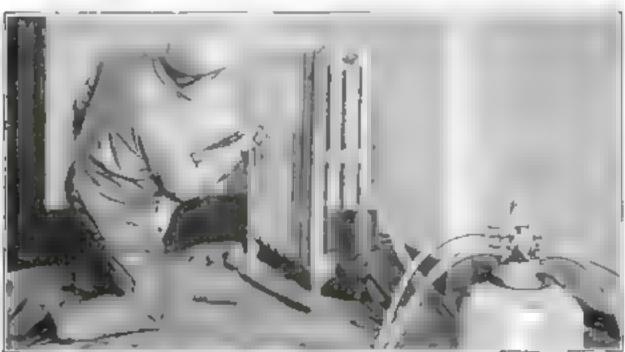


Testing the endurance of various lands of paint on concrete surfaces. Structur tests have been made on cloth, steel, wood, and other

materials in different parts of the country to determine the proper paint to two under varying climatic and meeting conditions



In Eght colored cages unimale grow capitly, while dark point returns them. Note how this subject is attracted to the light spot.



Radiators painted whate give 20 per cent more radiation than unposated ones. Other colors in order of their radiation values are cream, red, green, yellow, black, abunianum, and brown

the paint industry has grown in value from \$200,000,000 to over \$400,000,000 a year

"In the days when any paint was used for any surface," Mr. Gardner continued, "people who lived in factory or mining cities found the paint on their houses turning brack from chemical lumes. It was discouraging to paint anything white,

and even light colors soon became streaked and sooty.

"House owners were in despair. But meanwhile research went on, and today we have paints that remain unchanged in atmospheres of hydrogen sulphide and similar gases. One of these paints is made from a white pigment now produced from titanium ores, a large quantity of which is

found on the sands of the Florida beaches. Tests made on houses where an abnormally high percentage of hydrogen sulphide is present have shown very white surfaces and great durability for several years.

"A NOTHER development that has brought about an entirely new Yogue in interior decoration in houses and factories in the large-scale production of lithopons, one of the newer white higments. In 1907 lithopone was being introduced gradually to the paint trade. Combined with Chinese wood oil varnishes, manufacturers were able to place on the market contings of great hiding power and extreme whiteness. marked the beginning of a nation-wide fashion for painted walls, and today it is the custom in hospitals, hotels, apartment bouses, and many public buildings to use paint upon wall and ceiling auriaces. In factories the amount of electric current exved through the use of modern, sanitary, light reflecting paints has more than balanced the cost of the paints and their application. Over 100,000 tons of lithopone is now used annually in the United

"Another white pigment that the pointgrinder could not do without is sine exide —the whitest pigment produced. Its use in interior enamels and as a component of exterior paints are its chief applications.

"The development of paints for acidmanufacturing plants, packing-houses, iron beams of smelters, pipe lines, underground timbers in mines, and similar structures all form stories of interest. The necessity for special paints has thus built up the ready-mixed paint industry. Hundreds of tests are made before the formulas for these paints are finally adopted."

Recent accomplishments in the painting of metal, especially adaptable to the automobile, were explained by Mr Gardner:

"The automobile industry has been largely dependent on vegetable oils for desirable coatings, but now, through an adaptation of guncotton, a new type coating has been developed in the industry, it will not replace the old high gloss variath finish, but will be used indefinitely for special purposes. We grow the bulk

of the world's cotton and we get nitrie send from the sir—the two products required for the production of nitrocellulose, the base of this coating. Previous to prohibition we produced fusel oil, from which a solvent for nitro-cellulose is made. Now there is produced in America a solvent known as butyl acetate, used widely in these new finishes. For coating wood it has not reached its ult mate development

"REVERTING to metal paint in genbeen made to discover formulas to best protect from and steel. In different sections of the United States we have set up series of painted metal panels for long periods. Many of these were exposed on Young's Million Dollar-Pier in Atlantic



A tung tree in bloom. Large nersages have been cleared for tung accillage. These promise to rivel the grapefreit and arange trees

City. The application of principles thus learned, means an annual protection from tust of several million dollars.

"Field tests have also been made with steel fence wire, coment structures, shingle roofs, and metal and wood roofs in varying climatic conditions."

My conversation with Mr. Gardner turned to the scarcity of drying oils and the growing demand for them. And here he told me about a whorly new industry, which paint research has brought to America.

"IN RECENT years," be said, "Chinese wood oil or tung oil has been most important as the basis of practically all waterproof varnishes. During the last two years the price, normally about one doday a gallon, rose to over four dollars, and even at that most of the oil was effulterated.

"The Department of Agriculture, however, had brought over a few of the tung nuts about 12 years ago, and planted them in a few Southern States. I visited these places on several occasions during the last few years. Among them were 10 trees planted at the University of Florida, on the grounds of the State Agricultural Codege at Gainesville—some 50 miles southwest of Jacksonville. These trees are fully as vigorous as any in China. The growing of sufficient trees to produce the oil for America was then brought to the attention of the Educational Bureau of the Paint and Varnish Manufacturers' Associations. At a recent convention a

Mountain of the tong

tier all grown in Florida for he oil in ets note. This oil m the basis of many waterproof varpiable

fund was subscribed to start Ameneur tung-oil indus-

"Fortunately, the year before a large quantity of nute from Florida had been planted in a small numery, and over 100,000 needlings

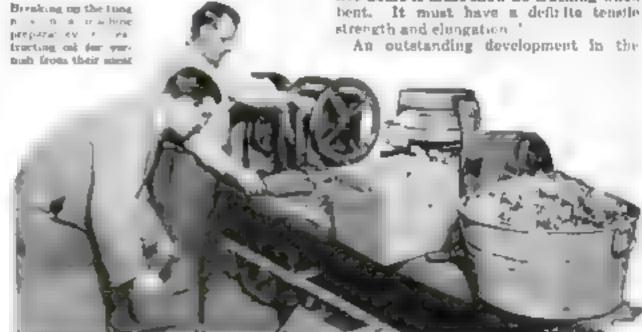
produced. During the last three months we have cleared large acreages in northern Florida and planted over 25,000 young seedlings, and something like 25,000 seedlings in individual small tracts adjucent to Gamesville. In this work the Department of Agriculture and the University of Florida have given full coappear that the tung-nut tree, properly cultivated, will be the selvation of northern Florids, and that within a few years there may be sufficient groves planted to meet fully the requirements of the American varnish industry. The oil from the Florida nuts is superior to that from China. We have a large nursery at Gainesville, where we are growing seedlluga for dimenunation to agriculturista throughout the northern part of the State.

"In a similar way our Educational Bureau has inaugurated much work in the Northern States, where flag is raised for linesed oil. The study of flax diseases, well conditions, methods of planting and harvesting, crop rotation, and so on, have been carried on in a scientific manner, In all this work the State Colleges of Agriculture in North and South Daketa have cooperated.

HE industry is always on the watch for newer paint oils and resins, and far parts of the world have been accured. We have investigated the oils from many species of nut-hearing trees and seed plents in Japan, China, the Philippines, Australia, Mexico, and other foreign countries; the oils from the waste raisin seed of California, from the soys beannow grown quite widely in America-from the chie plant of the Southwest, from a dozen different sea animals, and from other sources. Many of these have good drying properties and are applied to a limited extent."

The story of varnish is quite as interesting in many respects as that of paint, Continued research has built up almost unbelievable quanties in varnish coatlegs.

"Few consumers have any notion of the grueling trials that modern, high-grade varnish must withstand," Mr. Gardner explained, "Some of the tests for standardiged water-resisting spar varnish are these: The dried film must survive immersion in cold water for 18 hours and in boiling water for 16 minutes without whitening or dulling. It must show no dulling, crow's-footing or frosting after five hours' exposure to gas drafts. After baking in an oven at about 100° C. for five hours it must show no cracking when



operation to members of this Institute. "Thus is of great interest to northern Florida agriculturists, as frost played havor with citrus fruits there. Peanuts and cotton largely constitute the agricultural pursuits in that region, and do not average over \$20 yield an acre. It would

paint industry was the coming of the spray machine, which completely uprooted traditional methods of painting in factories. In automobile plants esperially, appraying has almost superceded the hand brush.

(Continued on page 126)

### the Sun Never Shines the Majestic Depths of the Sea

formations of the ocean basin is what is known as Telegraph Plateau, a great ridge that extends in almost continuous line from Newfoundland to the British Isles. The discovery of this ocean eminence was of great importance in aiding the establishment of transatlantic caple communication; from which fact it derives its name.

YOU know, of course, that most of the sen is a beautiful transparent blue. Just why this is so, science cannot say. The reflection of the color of the sky probably has something to do with it. Likewise the varying depths; for the deepest blue is found far from land, while shallow waters, especially in the tropics, are always green. The Arctic Ocean, too, is green. Submarine vegetation here and there affects the color of the sea. Thus the Red Sea gets its color and its name from the reddish algae, or seaweed, that float near its surface. Elsewhere soil and mineral deposits from the land tint the waters near the shores.

Also, the purity of the water has some nearing on its color. A tank of the purest distilled water is blue, and virtually matches in color a specimen of water taken from the sea. However, the sea is transparent and translucent only near its surface. Below 500 fathoms (3000 feet) the light of the sun does not penetrate, ifence, all the vegetation of the sea is above that level, for plant life requires the light of the sun to reduce the carbonic peid needed for its existence

Below 250 fathoms, or about 1500 feet, the heat rays of the min cannot penetrate, and their effect is weakened considerably



A remarkable simplace photograph of the waters of East Rocksway Intel L 1 taken from a beight of 10 000 feet and revealing in the scena a deep channel in the foreground submerged tend bars, and a meandering stream on land

Measuring ocean depths with the latest form of electric deep-masounding machine from one of the vessels of the U.S. Court and Geodetic Survey. The greatest known depth near the court of Mindanso, Philippine Islands, was measured in this way.

above that depth. The result is that there is a thin layer of warmish water on top of the sea, below which the water is cold. At 50 fathoms science has found that the temperature of the water varies little more than a degree a year. At 100 fathoms there is no change in temperature

at all. All the water under 500 fathoms, which means about 90 per cent of the ocean, is colder than 40 degrees, while at the bottom the temperature in 32 degrees, or less—just above the freezing point for salt water, which is 28 % degrees.

All of the ses is salt, though some parts are more salty than others. The degree of salmity depends to a great extent on the climate. Where the best of the sun causes much evaporation—as in the Red Sea—a large percentage of salt is in the water

Where the evaporation is less, the percentage of salt is correspondingly less. Throughout the whole ocean there are about 35 pounds of sait to each 1000 pounds of sea water, about 5,000,000 cubic miles in all, or more than enough to bury the United States a mile and a balf



deep. We speak generally of the "sait" of the ocean. actually we should say "salts," for in addition to andrum chloride—the salt we use with our food-the see contains the saits of many other metals. In fact, the cen in a veritable treasure house. There is more gold there, for example, then ever has been mined from the land-about a grain to every ton of water. Silver is there, too, though only in about onefifth that quantity.

Thirty-two of the 92 elements known to exist have been found in sea water. Scientists believe that most of the others are there, and await merely the development of new methods of chemical analysis to bring them to light. These chemicals have been washed into the sea from the rocks of the land. Every year

500,000,000 to ne of salts are carried to the sea by the American rivers mone.

The water of the ocean is in constant circulation; it has its rivers, its lakes, its seas. These are due to the action of the sun, which brings changes in temperature, in wind, and in the density of the water

THE Gulf Stream probably is the best known example of an ocean river. Starting at the Gulf of Mexico, this warm flow of tropical water skirts the American coast to the banks of Newfoundland, where it takes its course across the Atlantic and divides into two streams, one flowing cost toward the Azoros, the other passing the shores of the British lales and Norway and disappearing into the Arctic Ocean

The waters of the Gulf Stream are blue, often in marked contrast with the greenish seas through which it passes, It exerts a profound influence on the climate on many parts of the world. Thus, it carries a comparatively mild climate to Scotland, while Labrador, in the same latitude at the other side of the world, is a place of ice and cold. Similarly, Portugal, whose coast it washes, is extremely temperate, while a corresponding part of

(Continued on page 128)

## How My Speed Rocket Can Propel Itself in a Vacuum

By Prof. Robert H. Goddard

Head of the Department of Physics, Clark University

THE plan of Professor Goddard to shoot a small model of a high speed moon rocket within the next few weeks, as described in the April issue of POPULAR SCIENCE MONTHLY, called forth this quostion from many of our readers:

"How is it possible, as Professor Goddard proposes, for the rocket to propel itself by successive charges exploding in space? Since the space beyond the earth's atmosphere is practically a vacuum, what is there for the explosions, or expelled gases, to push against?"

We put this question to Professor Goddard himself, and he willingly prepared for our readers the following scientific explanation of how he believes his rocket will be able to propel itself in a vacuum. -THE EDITOR.

DISCUSSING the high-altitude rocket, there is not much question as to the long ranges possible, if a high velocity of the expelled gases is had with a

rocket consisting chiefly of pro-pedant material. There is, howover, much criticism of the idea of the rocket propelling itse fig. a height where there is pra cally a perfect vacuum, it b maintained that there will be "nothing for the explosions, or expelled gases, to push against "

Contrary to common suppr tion, however, the explosions have a greater effect in a vacuum than in the air. In fact, if the a r were very much compressed, the explosions, instead of giving strong propulsion, would have no offect whatever.

To see this, it must be researched that what pushes the rocker !--ward to the gos that is shot back

toward the rear. Thus if m boy on roller skates throws some weights backward, he will be pushed forward by the reaction, as shown in Fig. 1 The faster he throws the weights, the faster he will be pushed. forward /In a. vacuum, the gases from the rocket will escape at a high speed, and the rocket therefore will continue to be kicked forward by the reaction.

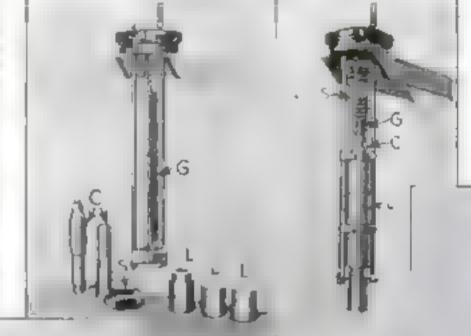
EVERY one knows ridge, fired in a revolver, produces a kick of the revolver; and the apparatus shown in Fig.

2, in which a blank cartridge is fired in a revolver free to turn about an axis, shows that the kick occurs also in a

The gases were prevented from rebounding by being shot downward into a tubular tank, Fig. 5, in which they circled around and around, being gradually

slawed down by friction, with no possibility of their rebounding. Another, larger tank also was used where the gas was state of a sentence of a tree for he waste presented to bound of the gas.

"HE results of 80 tests proved that there is \$0 per cent greater billing force of a rocket in



On the other hand, if a Liank cartridge could be fired in a tank containing air under a pressure so great that no gus could escape, then there would be no motion of escaping gases to give a kick to the revolver

Ask any engineer if he would descard the condenses on his engine, in which steam exhausts into a partial vacuum, and replace it by a tank under pressure. He will tell you that if there were sufficient bressure in the tank into which

the exhaust passes, it would stop the t a se. The same principle applies to the rocket.

N ORDER to test this point, a rocket chamber was fired in a tank pumped down to but 1/1500 normal atmospheric pressure. The chamber C, shown taken spart in Fig. 8, was weighed down by lead jackets L, and hung by a spiral spring S, as in Fig. 4. When the games were fired downward, the recoil kicked the chamber upward, and the rise was registered by a scratch on a strip of smoked glass, G. The apparatus shown in Fig. 5 has been widely illustrated under various titles, but it simply is the device used in measuring the reaction in a vacuum.



Fig 5

a vacuum than in air at ordinary pressure This proof of reaction in a vacuum is but one of a number of matters that have been settled experimentally, and that will lead to rather startling results.

Can you imagine two vast flaming balls one of them 8,000,000 tunes our earth in volume—hurtling about each other in a 173,000,000-mile path every two weeks! Read about this wonder of the akies in next month's issue.

### Swindlers Who Rely on Science

### Mechanical Tricks of the Carnival Bunco Man

As told to Walter B. Gibson by a Return Showman

PROBABLY you know the traveling carrival. A tented city of colored carvas booths, blatant music, bawling voices, and jostling crowds Calliopes and mechanical bands harring out their noisy tunes. Flaring lights the

luminating the stands of refreshment venders, and a myriad of sideshows. Everywhere noise, hurry, and confusion.

Probably, when a carnival has come to your town, you've bought numbers on a prise wheel, thrown baseballs at canvas-covered cats, or roiled little wooden balls down tiny bowling alleys, trying to win one of the many flashy prises so enticingly displayed.

Has it ever occurred to you how seldom you have won, or how seldom you ever have seen any one else win?

The explanation is simple. While there are plenty of honest men and games in the traveling

shows, many of the games of "chance and skill" that are prominent features of every carnival can be made cunning swindles by misuse of the principles of science.

Now, a dishonest carnival gamester, or "grifter," as he calls himself, probably

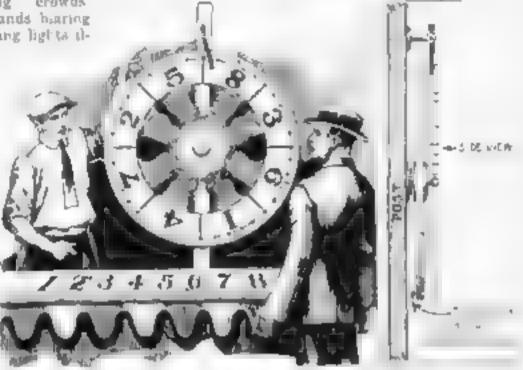
Same of the same o

The "end spot game is found at almost any carment. All you have to do to some a prise it to drop five metal dusin so they will cover a painted circle. But unuses you descover a trick bulge in the circle and cover that bulge first some portion of the circle always will remain exposed. A crooked operator knows where the bulge is by the aid of a very fine mark that a player would not notice

doesn't fit in with your notions of a scientist, and yet he is just that, for it is by employing the laws of physics and mechanics that he fixes his games to remove your chance of winning. He's a psychologist, too. He understands the workings of your mind and uses that knowledge to coax the money out of your pockets.

The games of the grifter fall into two

general classifications—games of chance, in which you trust entirely to luck to win a prize, and games of "science and skill," in which your chance of winning presumably depends on your own shility. The games of chance usually are operated



The operator of a crooked percentage wheel save he'll pay you 10 to 1 if the wheel stope at a number corresponding to the number on which you place your money. To make a clean-up he defuly

pushes a leaded therebrack into the facility of the wheel opposite a number that is not bring played. How he takes adventage of the law of gravity to take your makey is above in the side-view diagram.

fairly, for bere the well-known mathematical principle, the law of averages, makes the grifter a winner. When you win a prize on a paddle wheel, for example, there are always enough non-winners to pay for the prize and give the operator a profit to boot. Yet even in such a game the grifter employs his tricks to increase his earnings.

THE percentage wheel is one of these

"gaffed" or controlled by taking advantage of the law of gravity. It resembles a paddle wheel, but is divided into eight large sections, each of which has five subdivisions. Correspondingly numbered sections are painted on the counter. The player places a coin on the "lay-down." If the wheel stops at the number he is playing, he is paid 10 to 1, and if his coin is on the

center subdivision, 3 to 1. With the playing price a dime and eight persons are playing, five spins of the wheel pay the operator four dollars, from which, by the law of averages, his profit will be about two dollars and sixty cents.

But if all the places are not taken and the grifter wants to clean up, he deftly places a thumb-tack, weighted with a drop of lead, on the rear of the wheel opposite a number that is not being played. The weight of the tack causes the wheel to stop at the "open" number; consequently, the operator does not have to "pay off," and the "play" is all profit.

Some towns her games of chance, but allow games of so-called "actence and skill." One of the most popular games of this type is the kmie rack, where rows of attractive looking decrease knows has the

booth. When you pause at his stand, the operator above you how easy it is to drop a little wooden ring over the handle in order to take away the knife as a prise. He sells you six rings for a dime.

Even if you buy a hundred rings, you never will win. It is absolutely impossible to toos a ring over one of the knife handles from the angle at which you must throw, for the handles have stanting ends, and the knives are turned so that you are throwing the rings at the flat end of the handle that faces you, and not at the point.

THE grifter is a keen practical psychologist. He knows that you come to a carnival to have a good time, and that you are willing to pay for it. Take the "three-pin

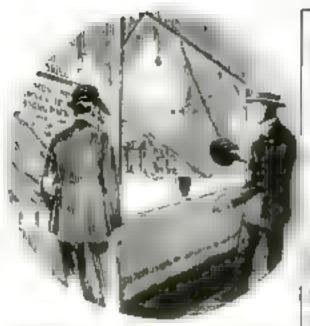
game." All you have to do to win at this is to roll a little ball down a miniature bowling alley and knock over three tenpins. If you do it, you get a dollar bill. But you never knock down more than two, because the two front pins are so set that the ball passes between them without striking both at the same time. If you get discouraged but look prosperous, the operator displays more of his "art," using a confederate known as a "capper"



Attempting to throw a ring over one of the summing pane on a crooking clotherhold game is bopeless. If you win you lose for the pamenter his relected winning numbers that he can transform into lovers by the simple process of turning the pin upude down

or a "shill" to lure you on. The confederate can make a perfect shot every time, because the operator has set the pins closer together for him.

The swing ball game is a notorious goldmine for the grifter Here a ten-pin



It hasha mile no with Mill by 4 pin with a swinging bonding ball suspended from a frame above. The name is amply to swing the bell to the right of the pro so that it will strike the gits coming back. But if a grifter is operating the game dishonestly. either he shifts the spacency frame throwing the ball off its course, as in A, in the diagram. above at eight, or be places the pin off center out of the line of swing, as indicated in B

stands on a counter lined with the inevitable flashy prizes. Bende the pinhange a bowling ball suspended from a frame above. The game is to swing the ball to the right of the pin so that it will

knock the pin over on its return swing. Purposely faulty construction renders the frame wabbly, so that the operator has only to lean against it to throw the ball from its course. The pin also is made lopsided and off center to set the game ngainst you.

To knock a large canves turn cat from a rack only a few feet away with a ball seems like an easy way to win a prize -hut try to do it! The cat leaves the rack only when the shill tries his luck. In this case the garmenter uses a little

The "three pin game" looks can. Yet if

a grifter wither, it is impossible to knock

over all three pins, because the two front pose are farther opert then the und h of the

hall as an Fig. 1. The grifter's confederate

however finds it every. For him the purs-are set closer together in ghown, in Fig. 2

physics to cheat you. Inside of the cat is

a movable weight. Pushing this to the bottom practically anchors the cat to the

shelf by lowering its center of gravity to

tts base. When the shill throws, the

weight is shifted to the center by tipping

the cat upside down. This rauses the



center of gravity so that the ball may easily knock the cat to the ground.

Another "game of smill" is called "Figs in Clover" You tip a board to roll half a dozen balls through spikes into numbered pockets at the other end Low scures give small prizes, high scores "grand" prizes. These PARSES SZE CORtroped by setting one or two spikes

in front of important boles, or else high or low numbers are lacking so that only moderate scoree can be made

Don't think, however, that the career of the dishonest gamester is a bed of roses lined with greenbacks. Quite the opposite. Prequently he is compelled to pay big money to grafting officials before they will permit him to run his game, or he may be forced to pay very high rentals for his booth space.

To avoid these hazards a class known as

"omall-time grifters" has ALL PROTES 5-46 BLANCE HED NUMBERS ( ) WIN LARGE PRIZES

When business is slow and the gamester's confederate appears to lare you on by winning a price a simple expedient to thalks been win in to cover the tops of losing numbers with the thumb thus

paratively primitive.

string and take the prime attached to it: yet you never get anything but a worthless trinket, because the cords attached to the better prizes are doubled back in the grifter's hand out of night and reach.

The grifter's ingenuity is shown by the way he "rigs" various forms of "strikers" that appear to be genuine strength-testing machines.

swings a wooden mallet to drive a lead weight up a long wire track to strike a gong, likewise is subject to control by the

operator. After ringing the bell once or twice, players always seem to lose strength. The track on which the lead weight travels is connected with one of the guy wires. When you start, the grifter leans against this trick wire, tightening the track and allowing you to score When he takes his weight from the guy wire the track becomes slack and the weight humps against the post. When the wire is stack, Samson hunself could pound all day and never hit the beil.

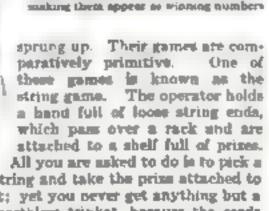
NO GAME is too large or too small to be controlled-not even the small "rolldown" or "haphazard" games that conmut of glass boxes into which marbles or coins are dropped to roll toward a row of pockets protected by protruding nails. These games are "fixed" by a movable row of concealed nails, which may be shifted to open or close the winning num-

One of the games that call for a little skill is the red-spot game. You'll find this game at almost any carnival. All you have to do to win is to drop five three-inch metal disks so that they will cover a painted circle. It happens, though, that the so-called circle is alightly lopsided. Some portion of it always will protrude unless this bulge is first covered, Only the proprietor of the game can pick

> this out with the ald of m very fine mark that players never notice. They fall for It because it looks so easy

> Yet I would not have you believe that all games such as are mentioned in this article are dishonestly operated. In a large number of them the house is content to let the mathematical law of averages take its course. It is with the tricks of the swindler that I have been dealing.

> Phinesa T. Barnum, who was the greatest of all showmen, summed up the lure of the carnival games in one immortal sentence, "There is one born every minute."



The "high striker" on which the player



When you try to knock the canvas cat from the rack with a thrown ball the dishonest gamester has you at his mercy. In some such games, shade the cut is a movable weight. Bhifting the weight to the bottom practically anchors the est to the rack by lowering the reaser of gravity

Don't join that number by rushing blindly into the grifter's bands. Patronias the rides and legitimate booths that you know are genuine and the gambling parasite will quickly fade away

It was I who first suggested the duplex as our solution of the housing problem,

and when I persuaded John to go with me and look at some, he discovered more

objectionable features in them than be'd

arrangement of rooms is one behind the

DUPLEX, of course, occupies only

one lot. Therefore, the only feasible

# A Five-Room Home in Three Rooms

# How We Designed a Duplex Bungalow that Pays for Itself

A. May Holaday

YEAR or so ago, John and I, like many another couple, were finding the housing problem shout the most difficult one with which we had to wrestle. We were tucked away three rooms and bath in a large apartment house. The rout was high, and other inconveniences - particularly the lack of room, freedom, and comforts - from which John suffered, made

the conditions under which we lived de-

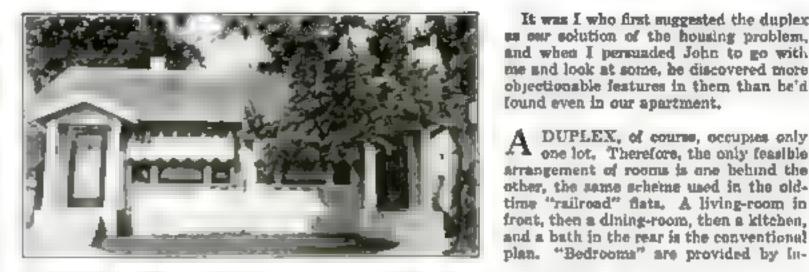
cidedly unpleasant.

Now, though, so far as we are concerned, the housing problem has ceased to exist. We are living virtually rent free in a real home with every comfort and convenionce we could wish for. There is less work for me: Juhn has all the room and freedom he desires. Months have passed since just I heard what used to be his nightly plea in the apartment: "Come on, ot's go some place -any place!"

WHAT we have done any other couple can do size. The way in which we solved the housing problem was nimost absurdly simple. We built a duplex bungalow. People who live in California will know what I mean. But for those who live elsewhere I'd better explain that a duplex bungalow is a one-story building divided into two spartments, each consisting of three rooms and bath. There are separate entrances, and the two families occupying the apartments peed meet no more often than their social Inclinations direct. Usually the builders of the "duplex" occupy one apartment, and the rest they receive from the other pays the expenses of the whole houseinterest on mortgage, taxes—everything

Now, fellow Californians and other people who have heard of the duplex plan are going to say right here that what John and I did was nothing unusus. T my're going to wonder what possible excuse I can give for writing an article about our dupleg, inasmuch as many thousands of them had been built and were occupied while John and I were still paying rent for an apartment. We didn't invent the daplex, they'll say; hence, what right have I to heroid what we did as an extraordinary achievement?

True, we didn't invent the duplex: but we did design a duples—the one we are living in-that is unlike any other in



Pront view of the attractive duples bungs low ingeniously deaugued by the writer The detailed floor plan and side oleverion are shown at the right

UNITED SPECIAL

the world. It took a lot of pondering and poncil-chewing to do it, but we succeeded in obtaining all the comforts of a five-room apartment in three rooms.

We utilized every square inch of floor space and wall space. We achieved not only

the appearance of roominees, but roominoss itself. Actually we have only three rooms; still, John and I never are in each other's way-we have even a spare bedroom when we are entertaining a guest! stalling wall beds that fold back in the daytime, in the living-room and diningroom. To get from the living-room, say, to the kitchen, you must pass through the dining-room, for doors opening from one

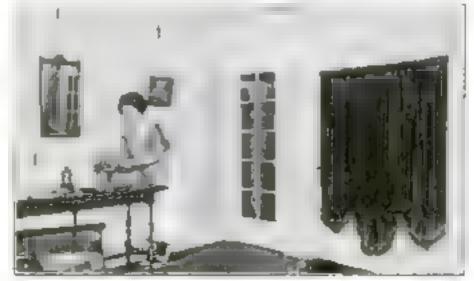
> room to the next offer the only way of walking from front to

VINIDES 4'4 TO WEAR P

After we'd inspected a few, John informed me that so far as he was concerned, a duplex was not for us.

"I'd just as llef live in a tent!" were his exact words. "I'm used to sleeping in a bedroom, and I'm not going to sleep in a dining-room for anybody! Another thing-a bathroom ought to be convenient. I don't intend walking through two or three rooms to shave! We'd better stay where we are. After looking at these things, I find the little old apartment isn't so had after all."

To tell the truth, I was a



A curuer of the fiving cuous, which becomes a bedroom at night The door to the bed closed at the right is made attractive by a silk drape. The door leads to a service hall, giving access to other rooms.



The sky bedroom is transformed into a conroom or ecving-room by folding the bed into a closet. One quick movement raises the bed, lets the footboard drop and closes it up

little bit disappointed myself. We were cramped in the apartment, but the arrangement of rooms in the usual duplex seemed to offer no rehef from that. Also, I couldn't help but admit that the other objections John had raised were sound.

AND then all at once a thought struck met Just because the room arrangement in all the duplex apartments we'd seen was unsatisfactory, it was no reason why our duplex should have an unsatisfactory floor plan! What was to prevent us from designing a duplex of our own, and eliminating the objectionable features?

I expressed this thought to John.

He merely laughed at me.

"Who told you you were an architect?" he demanded

"Nobody," I said: "but I'm going to design a new kind of duplex."

And I did—and we're living in it today. It wasn't done as quickly as all that. My first rough sketches, I'm afraid, were quite impossible. But there was an idea behind them, and when I showed them to John, he became so interested that he volunteered to help me, and between us we worked out the problem.

The first thing we did was to provide a bedroom that was to be a bedroom and nothing else. The rear seemed to be the logical place to put it, so that's where it

went. Since the bathroom should be convenient to the bedroom, the obvious location for it was next to the bedroom, so that's where that went-toward the front of the house. Next came the kitchen; then-well, what was the front room to be-livingroom or dining-room, or a combination of both? It was quite a problem, and its solution required much more ingenuity than either of us suspected we possessed

We decided at last that the front room was to be a living-room, and that we'd dispense with a dining-room antirely. Moreover, we eliminated the dining toom without subjecting ourselves to the
unplement necessity of
esting in the kitchen, for
between kitchen and living-room we placed a
most charming "breakfast
nook," easily accessible
from both living-room and
latchen, yet quite removed from all kitchen
"clutter."

Beside this, at the center of the back wall of the living-room we placed a ventilated bed closet. By day there is nothing in the

A cary dising-nool between the living-room and latches. Double French doors separate it from the living-room if desired. The table icids up

appearance of the livingroom to denote that, when
we have a guest, it can become a bedroom at night.
Yet the bed turns easily out
of its closet on its beavy
door, and behind it appears
a roomy, ventilated, clostric-lighted dressing-room.
There are clothes hooks,
ample shelf space for suitcase, and a full-length mirror on the inside of a door
that leads into a service hall.

The bathroom, showing indet

cubinet with muster door and

county towel cabanet below

That service hall we regard as the crowning achievement of our venture into

architecture. Probably more than any other feature of our duplex, it makes the apartments—ours and our tenant's—real homes. And very easily, too, we arranged for it, once the idea of providing a hall occurred!

We merely cut a four-foot strip from the uner side of kitchen and bathroom — space that could be spared easily—and behold! there was the hall, with a door leading into each room! No necessity of crossing one room to reach another! At the ends of the hall are French doors, admitting light whether closed or open.

That, in a few words,

describes the general plan of our dupler. The feature that has attracted the most comment from visitors is the breakfast nook, which we use for all meals. When the double Franch doors at the living-room end are thrown open, the nook becomes a part of the living-room, and gives an appearance of spaciousness that is quite amazing. Closed, the gauss drapes on the glass doors conceal the table and benches from view. The nook then is part of the kitchen.

When necessary, one leaf of the table, which is portable, may be dropped, thus affording a passageway between living-room and kitchen.

JOHN'S comfort received first consideration when we planned the bathroom. Two windows, with a shaving cabinet and a large murror between, and an electric light above, give him all the light he needs for shaving. A towel cabinet beneath the mirror supplies John with a dressing-table.

Five windows in our rang bedroom give us sufficient reason for calling it, as we do, a "sleeping porch." It is light, airy, quiet—has all the advantages a bedroom should have. The wall bed is easily put out of the way during the day.

In the kitchen are drawers and cupboards aplenty. A "cooler"—a tall cupboard with heavy wire shelves, vented top and bottom, holds vegetables, milk and similar supplies. There is a built-in ironing-board that folds down near the



This small but convenient enamified kitchen has plenty of drawers and cupboords, as well as a built in ironing-board that folds down near the gas-range when it is to be used

white-enameled gas-range, allowing plenty of room for ironing

We also have supplied abundant closet room. The dressing-room behind the wall bed of the living-room supplies an admirable clother closet. There is a liner closet in the hall, also a broom closet large cough to contain the entire cleaning equipment of the apartment. We have a rear porch, containing a wash tray. There are inside steps to the small cemented basement, and an automatic gas-heater that supplies hot water in kitchen, bath, and wash tray. A combination bookcase and desk is built into the living-room.

IF YOU'RE tired of paying out rent, or desire to live in your own home for any other reason, I commend to you a duplex bungalow of the kind that John and I built. If the duplex plan has not yet reached your section, don't discard it for that reason. Maybe you can start the style in your town and win fame for your-self while you are building your home!

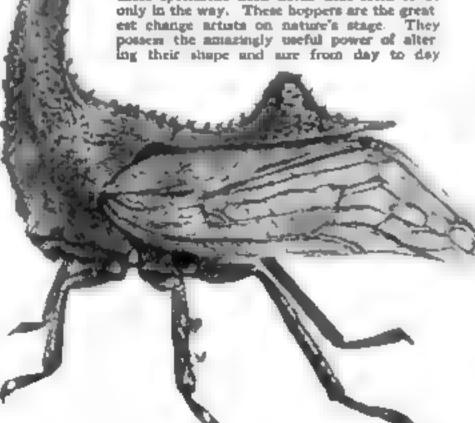
# Insect Hobgoblins of the Tropics

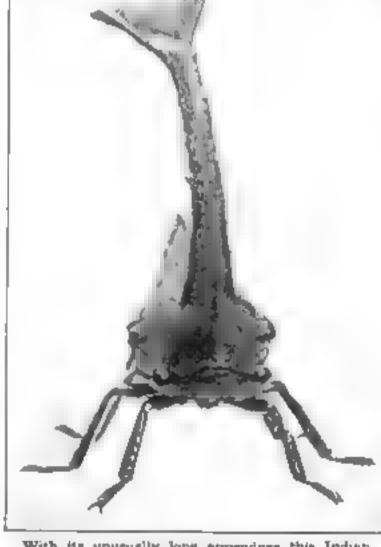


Tree-hoppers of India and South America are the newest insect wonders presented to the public by science. They are tiny and gorgeously colored, and probably the most grotesque creatures that ever came under the microscope. The pictures on this page are from greatly enlarged wax models prepared at the American Museum of Natural History. Note the intricate, ewordlike born curving over the back of the Brazilian specimen, shown just below

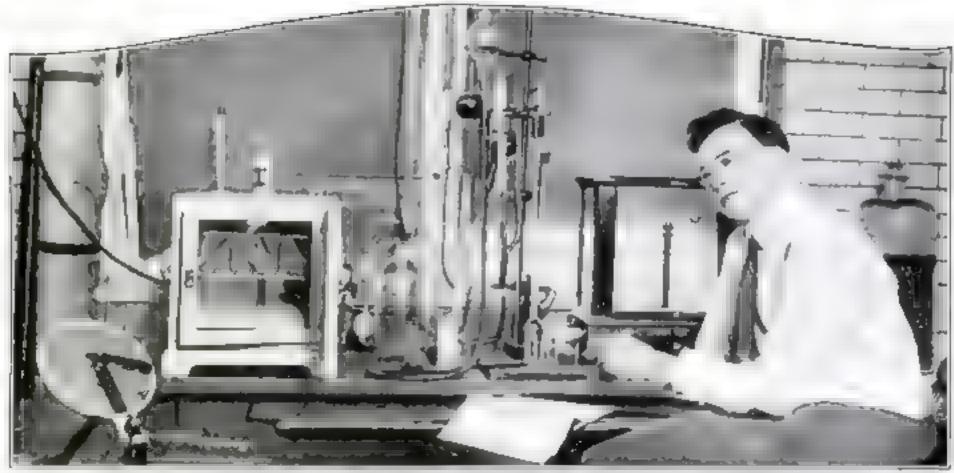
This specimen also is a native of Bearil. It has four eyes—two large protruding upper ones, and two below partly developed. The apper eyes have a keen, droll look, and the line that separates the head in some instances gives it the appearance of wearing spectacles. It has three pairs of legs, the longer being behind. With these it is able to jump considerable distances.

This insect, from India, suggests a turkey glancing backward. It has an anvil shaped hump on its back. Underneath are the wings Entomologists have not been able to tell why these specimens need borns that seem to be only in the way. These boppers are the great est change artists on nature's stage. They possess the amazingly useful power of altering their shape and size from day to day





With its unusually long appendage this Indian specimen bears a striking resemblance to a giraffe. Note its eyes just above where the legs join the body. They suggest automobile headlights. This creature is even more clumsy in its movements than some of the other awkward tree-hoppers.



In the laboratory of the U. S. Burtau of Chambery-making occident ten from the leaves of the wild causing plant

# - How Chemistry Is Feeding Us

MORE and more the world is coming to realize to what a startling and almost incredible degree the application of acientific knowledge has changed the aspect of productive industries. Back of our modern engineering and mechanical marvels, our automobiles, akystrapers, sirplanes, and bridges, stands the scientist, working in his laboratory to supply the materials of new and improved quality without which the triumphs of the engineer would be impossible.

In every direction eager experimenters are on the track of new discoveries. In seeking ways to eliminate waste

in the production of power, they are searching radioactivity and the atom for new sources of energy. Likewise, to meet the world's demand for food, they are studying new methods of increasing the productivity of the soil and of eliminating waste effort on the farms.

It is this fact field of research—science on the form that Doctor Hendrick discusses here. Has in a fuscinating and authoritative article on the achievements of synthetic chemistry in answer to man-made demands. — The Entrop.

"The Old Homestead" that was very popular. In it Josk Whiteomb, a sweet-natured and unsophisticated old farmer from Swazey, N. H., went to New York to look after a boy. The marvels of the great city had their effect on him. Having written home, he asked a passing stranger to direct him to the post-office so that he might dispatch his letter. The stranger pointed out a mail-hox, and said if he deposited it there it would surely reach its destination.

The farmer followed the advice; then, turning slowly away, he exclaimed, "Now, by gracious, I suppose that letter is halfway up to Swazey!"

Now we, who used to chartle at the credulity of the old man in the play, very often are like him when the talk is about science. There are some of us, for example, who be-Leve that we soon shall have all our food made in chemreal factories out of air and water and carbonic-acid gas. that even farming soon is to he a thing of the past, and that chemically prepared food will come to us in tablets that we shall nibble.

These notions are mere guesses, unsound economic-

#### By Eliwood, Hendrick, Sc.D.

ally. The farm is not to be supplanted by the chemical factory, although the farm already is beginning to draft the chemical and biological laboratories for its own purposes.

Even if we chemists could make up tasty and nutritions foods out of inunimate matter, instead of out of things that have been through the processes of life, out of things that have grown on the farm—and it's a fact, we don't know how to do it - there isn't power enough avaiable to make the food for the world in
factories. We should require coal or
water power or fuel oil, while the plants
and trees use the power of light direct
from the sun for their growth. We cannot
use light for power. Every green leaf has
us beaten in this respect

Again, our internal organs are so constructed that if we undertook to live on tablets without the necessary roughage or coarseness of food, they would collapse and the whole world soon would come

> down with an international bowel complaint. Let's keep our feet on the ground. Men of science have to do so.

BUT don't be disage pointed. Science, working along practical lines, already in accomplishing amazing things in solving our food problems. Consider, for example, the problem of obtaining nitrogen fertilizer so vital to our farms. Four-fifths of the air is nitrogen and plants must have nitrogen in combination-fixed nitrogen, as it is called-to grow. Now nitrogen fertilizer from the air aiready is being made on a large scale in Germany Also. Dr. A. Larson, of the U. S. Government's Fixed Nitro-



Dy H. C. Gore, of the U. S. Bureou of Chemistry converting cornnate a new engar chesper than come sugar and sweeter than placese

gen Research laboratory, has worked out a process that is nearly doubly as effective as the German method.

Another problem in connection with fertilizers is that of mixing them. Farmers haven't been able to do this very well, and so have paid freight on 20 per cent fertilizers mixed with 80 per cent gypsum or earth. But the farmer is coming around

to mixing the necessary chemicals himself. Think of his saving on freights when he does!

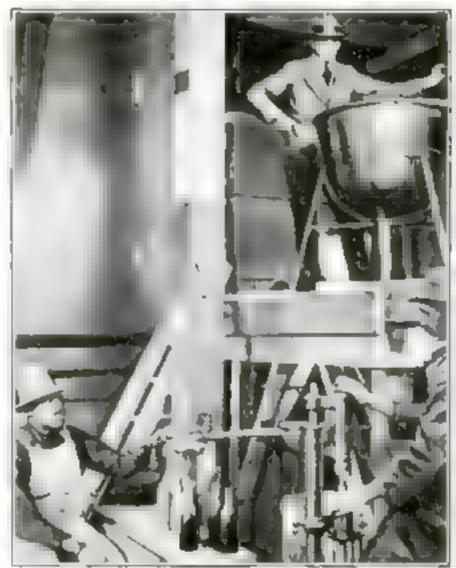
AGAIN, instead of making "superphosphate" fertilizer out of finely ground phosphate rock and sulphuric acid, one concern is extracting the phosphoric acid from the rock, avoiding the waste by washing, using the lean as well as the rich rocks, and getting the pure white crystals available for use.

Human, the result of decayed vegetable matter in a state of very fine particles, is another product greatly needed by the soil for the vigorous growth of plants. Now the prospect is fair that within a few years the newage problem will be solved That is, the sewage of cities and towns, instead of polluting streams and threatening public health, will have all grease separated from it, because greate destroys the fertility of soil. It then will be divided mechanically between fluid and solid, the thid chlorinated and rendered wholly harmiess, so that it does no dumage even to the fish in the streams. The sludge, or noted will be so treated and dried that it becomes an odorless, inoffensive, low natrogen fertalizer that is ideal for mixing with other chemicals

Another very valuable source of humas will come from a process under development at the Rothamstead Experiment Station in England. Straw, chaff, stalks, and other farm waste is fermented by means of a special enzyme, or yeast, and in two or three months turns into an

ideal humus, fairly rich in nitrogen. Straw now is burnt as waste on the great wheat farms.

Such scientific feats demonstrate how much may be expected from our chemists in making food indirectly from waste stuffs. So also does the way in which carbon-dioxide from the stacks of blast fornaces is being piped to farms and



Making high grade eyrup from unmerbetable sweet potatom that formerly represented a waste of about 40 per cent of the nutric trop. In the process developed by government character the potatom are boiled treated with a little main and crushed uptil they yield a julior that is reduced by evaporation to a syrup resembling come spraip.

so made to increase the yield of crops.

The leaves of plants and trees take in water vapor and carbonic-acid gas from the six and by a remarkable chemical

the air and by a remarkable chemical process, using the light of the sun for energy, resolve these two vapors into the

principal constituents of the plant, giving hack oxygen to the air. In iron blast furnaces the exhaust gases contain large quantities of carbonic-acid gas that put out fire, together with other gases that will burn. It is profitable to separate the carbonic-acid gas from the others, using the latter as fuel. But instead of wasting the carbonic-acid gas, it can be flooded

over neighboring truck gardens, and thus cause a luxuriant growth of vegetation

Industrial alcohol works also produce vast quantities of this gas, and it may become profitable to produce it locally if timestone is available and if near by is some industrial establishment that produces a waste acid.

SO MUCH for making the soil more productive. In the meantime it is well to bear in mind, to the credit of the American farmer, that in the 20 years following 1900, he not only fed and clothed the American pecnia, but exported wheat and other grains, allayed starvation in China and Russie; and thus despits the fact that at the end of the period he was cultivating-If per cent lem acreage than at the beginning, with 88 per cent fewer persons to work for him: for within that time some 4,000,-000 workers transferred their activities from agriculture to industry. We mustn't kick if the farmer is a little slow in adopting some improvements. He is short-banded.

One important means of conserving the food we produce lies in canning. The American Canners' Association maintains a large research inhoratory in Washington where improve-

ments in factory methods, in the tasto and keeping qualities of food products, and the avoidance of waste, are worked out. Canning alone saves a vast tonnage of fruits and vegetables avery season (Continued on page 131)



Community has appeared to the of thank in the four manager for the old days the miller felt the flour between his forefinger and thumb to determine its quality and texture. Today elaborate chemical laboratories are part of every great milling plant. Here flour is tested for numbers

values, and deficiences are remedied, with the object of making each size of bread a perfectly balanced ration of food. The woman in the picture is testing the sale of burst flow in a New York floor mill and is one of a large staff of expert chemists who are regularly employed by the mill

# Practical Science in the Making

# A Review of Recent Discoveries and What They Hold for You

The X-ray has been made available of home he by a portable apparation of by auto-conduct. Preserving a distribution of a distribution of a factor of a

MARIMON dex let or carhonse-neid gas, may be described as the "smake" if the body free. We exhate it from our lungs as "waste" after the oxygen we have previously absorbed has been at heed in the burn ng" process that reportshow the thouses. It is earbon dioxide tesu ug from many langa that causes theaters and similar gathering pinces of many people to become "stuffy." Carbon dioxide will not support primal ife. In fact, in a concentration of four or the per cent an the at on one topay he feed

to each that are comes of a careful at the gas work of itself asphyxiate, in more potent than Iresh air or even oxygen in reviving partially asphyxiated persons. And quite as automab-

ing is the suggestion recently made that this gas can be used to cure tuberculosis.

The value of carbon dioxide in cases of sufficiation is made known by Professor handell Henderson, of Yala University. The gas is normally present in the lungs and blood where, Professor Hendersonsays, it is necessary to stimulate the nerve centers that control breathing. Fresh air or pure oxygen administered to a victim of asphydiation, he asserts, tends to depress the nerve centers of respiration and make breathing more difficult instead of improving it.

NOR is this merely a theory, for Professor Henderson and his associate, Dr. H. W Haggard, have devised a breathing apparatus that automatically mixes about five per cent of carbon dioxide in the air supplied to a suffocated person. The effect is said to be a remarkable stimulation of breathing, so much so that victims of illuminating gas, carbon monoxide, and smoke, and surgical pa-

Experimentary operating the portable X-ray sensorates invented by Prof. A. M. Low noted British a mountain to expense the quality of metal in a sensorate

Dr. H J. Cooper, tuberculogis authority, of Denver,
Colo., asserts that carbon
dioxide may furnish a cure
for tuberculosis. Experiments with thousands of
animals, according to
Doctor Cooper, show that
the growth of tubercle bacilli is arrested by three per
cent carbon dioxide, while
the bacidi are killed by 15
per cent

It is Doctor Cooper's suggestion that the injection of carbon into the blood, in quantities so minute that the tiny blood vessels will not be blocked, will result in the depositing of carbon in the lungs and consequent formation there of carbon doxide in amounts suffi-

rient to kill the germs of tuberculosis. Remarkably enough, at just about the

time that Doctor Cooper was making this announcement, from the Pasteur Institute in Paris came word that Protessor Albert Calmette, assistant director, a noted tuberculous expert, was ready to demonstrate an anti-tuberculous vaccine to the development of which he had devoted 20 years.

This is not a tuberculosis cure. All that Professor Calmette promises for his preparation, which he calls "B C C," is that it will prevent the development of tuberculosis germs in persons who are modulated with it.

Tuberculosis is one of the few germ diseases that medical science has not yet conquered. Efforts such as those just described, however, undoubtedly will result in the control and eventual elimination of it.

Gun Ejects Airplane

SHOOTING an airplane out of a gun probably sounds like some imaginative novelect's suggestion, yet just exactly that was done in a scientific test of a new method of putting aircraft into flight, conducted a few weeks ago at the Naval Air Station, Washington, D. C. Before long this may become the standard method of launching airplanes from war-abip decks.

The plane is placed on a small car, mounted on tracks that end at a platform on top of a battle-ship's turret. The car is connected by a series of pulleys with a piston inclosed in a gun. When the gun is fired, the piston is driven forward, pulling the car almost instantly into a speed of



To improve the quality of American-made Swim cheese the U.S. Buresn of Sundards has perfected this cheese testing X-ray device. A deary expert of the Buresu is shown examining a cheese to determine whether it has sged sufficiently

Prof. F B. Litted

of the United

States Navy, using

the world's most

perfect senith tube at the Navel Ob-

servatory. Wash-

ington, D. C., to

CONTRACTOR STANSFORM

in latitude to the

60 miles an hour. At the end of the tracks hydraulic and apring buffers stop the car, and the plane is catapulted off, continuing under its own power

This method is said to be superior to the compressed-air catapults previously used. The plane continues its flight with no drop in altitude, probably because a charge of powder supplies greater momentum than the compressed air.

Also, it permits the launching of planes one after the other as fast as the gun can be reloaded and the planes set on the car

#### A New Helicopter

THE British Government, according to recent reports, is making a determined effort to develop a practicable belicopter. Several British inventors have tackled the problem under the auspices of the Air Ministry and one of them. Louis Brennan, is said to have

devised a machine that can rise and descend in perfect control

Tests of the machine have been made in secret.

Despite precautions, word has been received that the machine is capable of rising 25 feet or more, hovering for a considerable period and land-ing unburt.

The Brennen machine has not been tested in horizontal flight.

#### Explorers' School

FOR explorers, experience always has been not only the best, but the only teacher. No college offered a course in exploration until recently, when the American Geographical Society established a school for explorers in New York City. Dr. Hamitton Rice, well known South American explorer, conceived the idea of the school, and is its director

The scheme of instruction will be ontirely practical, based on the experience of noted explorers. Of course, in the country around New York, where field instructions will be given, the students will not experience the rigors of the jungle or the arctic regions, but the conditions of actual exploration will be simulated as well as possible. Thorough instruction will be given in surveying, mapping, and field astronomy

#### Science Finds a Way

SOME time ago adentists from the Smithsonian Institution established a meteorological station



To demonstrate the theory that atoms of matter are composed of electrons revolving him planets in a solut systems, around a critical nucleus, the General Electric Company has matalled on to research inhoratory the model atoms shown above. The electrons are indicated by small electric lights. Thus the theoretical arrangement of electrons in an atom of any given substance can be visuohead

Here to Dr William V Loader chief chemist of the United States Bureau of Chemistry under whose direction 80,000 samples of booting liquor have been analyzed by Ducle Sam this year. Of these, 71,000—or nine out of 10 samples—were found to contain poisson, anduding carbolic send, hydrochloric send, formaldehyde, acetone, and sodine

on a mountain in Chile. The purpose was to measure the heat of the sun to discover what relation exists between changes in the sun's heat and our weather.

Elaborate mathematical calculations were performed mostly at night, for during the day the scientists were engaged in making observations. The primitive oil lamps and candles that were the only means at hand for supplying light for the night work were unsatisfactory to eccentists who were accustomed to working in well equipped laboratories. The necessity for electric lights was apparent—but how were they to get them at the peak of a desolate mountain?

Recently they found a way. They built a windmill, installed a dynamo and storage batteries, and now their observatory, hundreds of miles from the nearest inhabited place, is as well lighted as if it were in the heart of civilization.

Thus does science triumph over obstacles large and small

Prote pressurements with the actuals tube at Weak ington and from observations at other satisformical observatories, it has been determined that the sate of the earth's rutation changes its position continually. The North Polymores around in a circle varying from 10 to 60 feet in discreter completing the circuit in about 4 months.

B. Ewitte

### Reducing Weight

STOUT persons, anxious to "reduce," usually make a special point of avoiding sweets. This is a mistake, according to Dr. James McLester, of Birmingham, Ala., who says that sweets offer a valuable weapon to those who would ose weight

Too much food, says Doctor McLester, in the usual cause of corpulence, and a slim diet offers the obvious remedy. A scant meal, though, he says, does not seem so scant if brought to an end with a dessert, and he recommends the practice of following lean meals with a weeks as an aid to perseverance with a "reducing" diet.

If owever, he advises against attempting to reduce the weight too rapidly. "A loss of three to six pounds a month," he says. "when continued sufficiently long, obviously will bring the weight to any desired figure."

#### Radio Storm Warnings

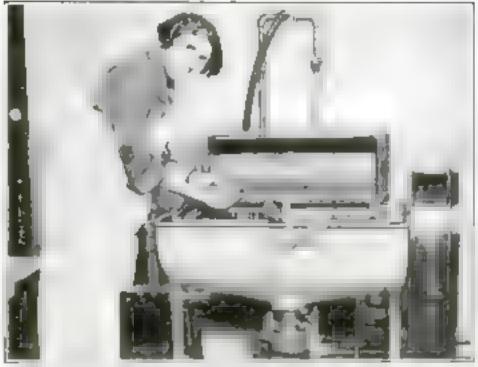
STORM warnings for ships sailing the northern seas shortly will be available from four radio stations to be established in Greenland by the Danish Parliament. One of these will be erected on the eastern coast, the others on the western coast

The eastern station, at Angmagsalik, will be especially useful for meteorological observations, because of its location in the path of storms that sweep the coast.

#### Money Cleansed by a Washing Machine

THE term "filthy lucre" has been banned from the English language as far as a certain Los Angeles hotel is concerned, by the installation of a coin-washing machine in which all money received by the hostely is cleaned before being returned to the guests in the form of change,

A rule is in effect in this particular hotel that no money that has not been washed and made sanitary and new in appearance is to be given out by cashlers, waiters, and other employees to the hotel guests.



How the used coins are cleaned in the hotel washing machine

# Compact Stereopticon Uses Rolls of Film

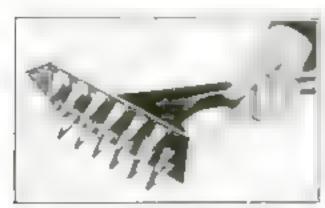
UNUSUALLY compact and easy to operate is a new type of still-picture projector that uses ministure views on

The new stereoptices, showing film rolls

#### Small Hand Tiller Useful for the Home Garden

FOR breaking up clods of earth and smoothing the newly dug garden surface, a new garden hand tool, known as a tilter, has been invented. It should be used with a hammering and spreading action.

The pointed front of the tiller can be used for making a furrow for meeting



This hand tool harrows the soil

strips of film similar to motion-picture film, instead of the causi cumbersome glass plates. Each film strip contains from 50 to 500 pictures.

The projector is 10% inches in height and weight only 4% pounds. It uses a standard incandescent electric globe, with a special resistance cord that makes it adaptable to any electric-light connection.

By means of a special insulating device the film is protected from the heat of the lamp so that a single picture may remain on the screen for hours. Or, if desired, more than a hundred pictures can be shown in a minute.

### A Telephone for the Deaf

USE of the cheekbone as a conductor to the auditory nerve, coupled with the amplification of speech, is reported to be the secret of a telephone for the deaf that has been put to test use by the Saskatchewan Government Department of Telephones.

It is reported that persons who have been unable to hear for years have been able to hear long-distance calls.

#### Garden Table Folds like Umbreila

An Ingenious table intended for garden use or for card games in the house, folds into a space about a foot long and three raches wide. The collapsible canvas top of the table folds on the principle of an unbrella, by the sliding of a ring carrying umbrella-like ribs. The longer ribs are straight, to make the top of the table flat.

The center post of the table comes in two sections, held in position by a slot in one metion in which pins in the other section ungage. Three spreading legs of tubing are attached to an aluminum

These legs are all the same length, but of three different diameters so that they can fit one inside the other. To a codar on the center post are attached four rings that serve to hold drinking glasses in the event of the table's being requisitioned for eard-playing.



The felding table ready for use

# Wooden Catboats Built on Concrete Forms

AN EASTERN manufacturer of calboats uses a concrete form on which to assemble them, thus cutting his finishing time in half and assuring complete uniformity.

Slots in the concrete are provided for the cross meces, to which are nailed the centerboard, sides, and bottom boards of the boat. The block not only provides a solid working base to hammer against, but enables the builder to keep the construction uniform and true without the necescity of constant measurement. The . concrete form

weighs about seven tons. The completed boat is 15 feet long, six feet beam, and is designed to carry a 25-foot must and 226 square feet of sail



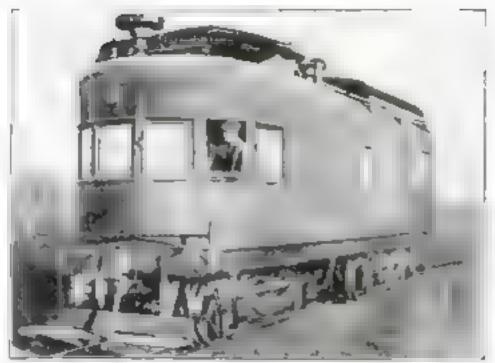
A weekman nating he buttom togeds a er he e narete bon orm

#### New Locomotive Has Diesel Engine

THE first electric locomotive to use an oil engine
of the Diesel type to drive a
generator supplying electric
power for the driving wheels
has been completed by the
General Electric Company
and the Ingersoil Rand Company. It is designed for
switching service and consumes from 20 to 26 cents
worth of fuel an hour. This is
approximately one-third the
cost of coal used by an ordinary steam switching engine.

The 300-horsepower, sixcylinder oil argine is directly connected with a 200-kilowatt generator. Four electric motors are used, one for each

of four axies, providing remarkable flexibility. Sufficient fuel for 46 hours' continuous switching service can be carried, and



Cooling radiator and schapet muffler are located above the reef

there is no smoke. Like an auto, the engine need be operated only when the locomotive is being used.

# This Machine Cuts, Binds, and Shocks Grain

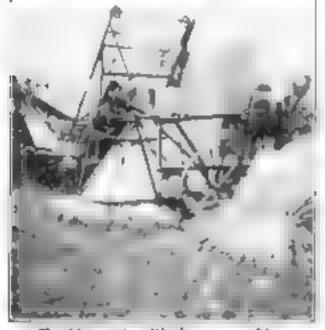
A MACHINE that not only cuts and binds grain, but deposits the bundles in shocks, has been developed for use in

grain fields. The shocker is attached to the binder in place of the customery bundle carrier.

From the binder the grain is taken by means of an elevator to a basket consisting of two separate cone-shaped parts supported at the apex. While one section of the basket is in a vertical position being filled, the other part is carried horizontally

In setting the shock, the operator engages a clutch that drives the upright member down on the sheaves, and moving the basket backward at the same rate the machine is moving forward, thus placing the butts firmly on the ground in an upright position. As one portion of the basket is setting the shock, the other turns into position for receiving new grain.

The shocker is graintight and is said to save enough loose grain in one year to pay for itself. It has few moving parts and its life is said to be twice that of an ordinary binder



Shotking grain with the new machine

# Salt Lake Man Has a Back-Yard Gas Plant

WHILE drilling a well to obtain a supply of drinking water, a resident

on the nutskirts of Salt Lake City, Utah, struck instead a well of natural gas. So be

connected a 300gallon tank with the gas flow and now uses it for heating, lighting, and cooking. The tank, which

The tank, which holds a day's supply, fills within an hour, and the owner row can light and heat his home without the fear that a gas company will shut his meter if he fans to pay his his.

Other residents of the neighborhood have drilled seeking u im it ar wells, but thus far without success.

#### Automatic Teller Takes Deposits

AN AUTOMATIC teller that receives paper money deposits and issues receipts for them is a new device designed to encourage saving among industrial employees. Bills of one-, two-, five-, or ten-dollar denominations are put into their proper alot. Pushing the handle directly beneath the slot produces a correct receipt for the money, which draps into a regulation safe below

The machines are placed in industrial plants, where deposits may be made at any time. At the close of each workday the cash deposited

by all employers is taken from the machine and re-deposited in a hear-by book. There each employee is given credit for the amount of his deposits when be shows his receipts.

The device is said to bring in many new savings accounts and increase deposits greatly.



Making a deposit in the machine

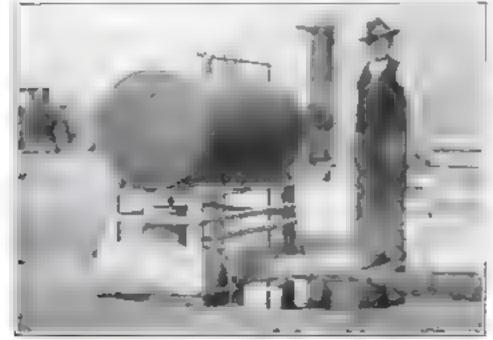
#### Bathing-Cap with Goggles Designed for Divers

FOR use by swimmers who wear glames, and to permit a diver to see under water and still keep the water from his eyes, ears, and nose, an elastic rubber bathing cap with goggles and coverings

Navel bathing-cap

for the pose and cars has been invented by A. G. Johnson, of Washington, D. C.

The cap is so constructed that it prevents the entrance of water, yet allows the wearer to breathe freely through the mouth and talk without removing the headplece.



The back-yard gas tank that holds a day's supply of fisel



# Bird Is Model for Airplane Helicopter

A NOVEL model of a belieopter sirplane, which the inventor claims will carry four times the weight of present types with one quarter of the power, has been patterned on some of the mechanical principles used by birds in flight. The upper and lower wings slope forward until they meet in a horizontal edge that cleaves the air.

By opening the V-shaped wings and alowing down the motor, the inventor, Dr. H. T. Randle, of Lawrence, Kanasays the machine can land on any flat-roofed building

#### Ornamental Lighting Posts Reinforced by Tin Cans

THE driveways and walks of San Antonio, Texas, are literally lined with tin cans, but not so that one may notice; for the cans are embodied in the electric-light posts.

Park Commissioner Ray Lambert originated the Ingenious method of utilizing much of the city's weste tin-can output



by using them for reinforcing ornamental concrete posts, as shown in the illustration. Conduits through the center of the posts carry the necessary wiring. The addition of a globe at the top completes an economical and ornamental lamp-post.



These odd whistlesmade by the Chipess from bembootubes and gourds are ettached to the tails of pigeons by fine wires, as shown above. The swift flight of the hirds through the whistles, producing a strange concert in the sky

# Giant Lobsters Caught off the Jersey Coast

TWO of the largest lobstern ever caught were taken recently from their despses baunts and placed on exhibition in the New York Museum of Natural History

The largest specimen weighed 34 pounds, was nearly three feet long, and

was estimated to be 50 years old. It carried many coars on its body from fieres marine combats. The smaller one weighed 28 pounds.

The haunts of these two submamarauders rice were off the Highlands of New Jersey, where their enormous strength and size enabled them to destroy and rob traps that were too small to catch them. They were finally brought to the surface elinging to the outside of an ordinary fish trap that they had been robbing.

Pigeons in Flight Whistle Concerts in the Sky

ONE of the queerest orchestras in the world plays music up in the sky. The players are members of a flock of pigeons, carrying various kinds of light air whistles attached to their tails by fine

The originators of this unusual idea are the Chinese. Flocks of the birds carrying musical attachments are sent through the air to provide a unique and

The musical instruments used are of

melodious serial concert.

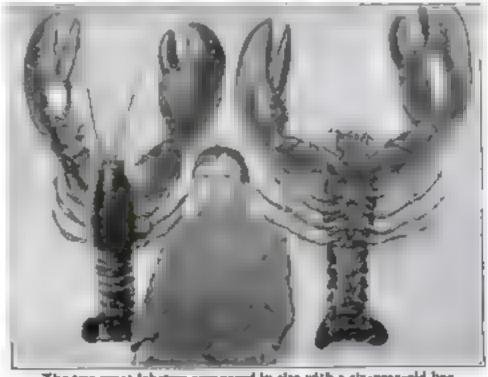
two different types—bamboo tubes, and gourds with tubes attached. They are lacquered in various colors and fitted with

mouth pieces that are operated by the rapid passage of the bird

through the air.

Willess.

When engaging in formidable combat lobsters are endowed with the ability to leave one or more claws in tight grasp of the enemy in order to escape. The lost members soon grow out again.



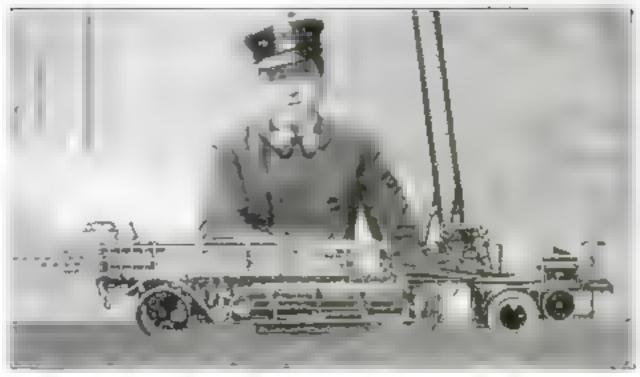
The two great lobsters compared in size with a six-year-old boy

#### Duplicate of the Tower of Babel Unearthed

THE remains of the great tower of Ur of the Chaidees in lower Mesopotemis recently has been unearthed, giving a clear idea of what this signard and its sister monument, the Tower of Bahal, looked like when they were built. The Ur remains are more than 4000 years old. Ancient ruins in the vicinity go back to the dawn of history, and are among the carliest buildings known.

Two hundred natives were engaged in digging, the work being carried on jointly by the British Museum and the Museum of the University of Pennsylvania. Earlier excavations brought forth day cylinders with inscriptions in which Nabonides, the last king of Babylan, told of finishing the tower, left unfinished by two kings of Ur, at about 2300 p.c.

The tower is solid throughout, with crude bricks inside covered with a facing of baked bricks laid in morter. Reed mats dipped in pitch were laid between the bricks. Three sides of the tower are perpendicular. On the fourth hage stars and to the summit. As each brick bears



## Miniature Fire-Engine Filed from Brass

A MINIATURE working model of a motorized book and indder, filed entirely by hand out of brant, recently was constructed by a fire captain in the Jersey City, N. J., fire department. It

was modeled after the first piece of mater equipment installed in the department.

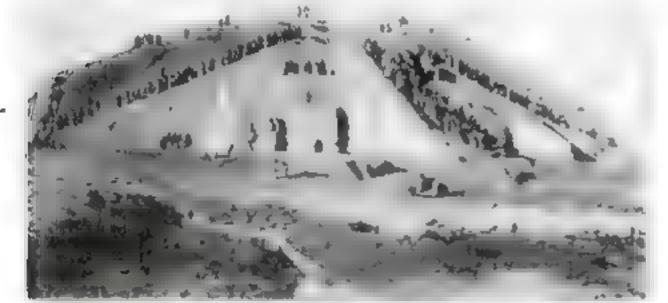
Practically every part of the real machine is embodied in the miniature, the only difference being that an electric motor is used instead of the gasoline engine employed in the origina.

# Smallest New York Store only Two Feet Wide

WHAT is said to be the smallest store in New York City, if not in the world, recently was opened for business by a locksmith, machinest, and electrician.

The width of the shop is 24 Inches. It is so small that customers cannot enter, and business is transacted through the window in the front door

The owner leaves by a door at the addthat forms one wall of his unique estacebment.



Encavated raths of the great tower of the showing staleways leading to the commit

the royal stamp, it is a simple matter to trace which kings had taken part in the building

This is believed to have been one of

many towers supposed to be imutations of the hi.is where the Sumerians worshipped their gods before they settled in the Tigris and Euphrates valleys.

### Three-Wheel Fire-Truck for Small Towns

A NEW German fire-engine combining a hose cart and a small hook and adder has only three wheels, one in front

and two at the rear. A gasoline motor supplies the motive power. There is senting space for three men. The apparatus

was turned out by the Krupp works It was designed coperially for use in small towns and villages where elaborate and expensive equipment is unnecessary Since two fire-engines are combined in one, the cost of fire protection for small communities is practically cut in had

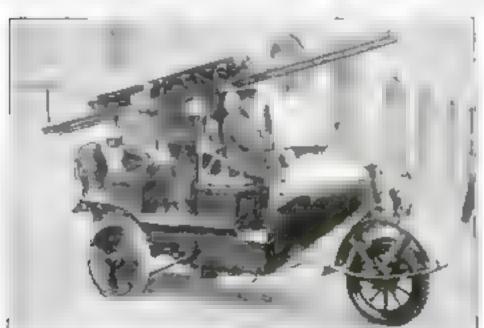
The tricycle machine is said to be remarkably speedy and easy to oper-



The smallest store open for business

#### Cow Bones for Chinese Game

THREE carroads of shinbones from cown slaughtered at a Chicago packing plant recently were shipped to China for use in manufacturing the popular tile same.



The three-wheel truck combines how cart and book and ladder



# Cutting Steel with a Torch under Water

AT A scientific exposition in Paris recently was demonstrated a method for cutting steel under water with a torch. To the usual oxymetylens torch is added a supplementary system of compressed air. This blows the water away from the mouth of the torch sufficiently to permit the oxymetylene gas and its electric are to function as usual

The diver carries the torch down with

him on his descent, one end of its supply tubes being connected with a barge above. When the torch is removed from the cutting surface, the flame is cut off.

The effectiveness of the method depends on the depth of water and the thickness of the metal plates to be cut. As the depth increases, the pressure of compressed air must be increased greatly to maintain the force of the cutting flame.

# New Stethophone "Broadcasts" Heartbeats

THROUGH the invention of a new best property and the human hearthest now may be "broadcast"

through a great number of instruments to inteners several feet away from the subject. The new machine amplifies the

sound of the heartheat three times.

The electrical apparatus that does the amplifying is moved on a wheeled table amfar to a tea-table.

It was demonstrated not long ago before 500 doctors attending the convention of the American Medical Association in Chicago, and promises soon to become a regular part of hospital fittings



### The Spectrum in Industry

Title spectrum, once used only by autronomers, now in beginning to play an emportant part in American into the development of a method of metals—a method S. Bureau of State-quamber of industries able new aid in detecting a in metal products.

tem has been used with success

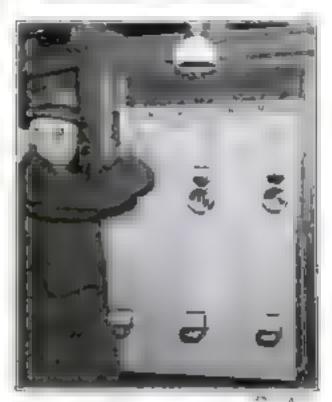
and tem has been used with success

#### Subway Coin Machine Makes . Change Automatically

ONE of the latest devices to expedite the movement of crowds in transportation is an automatic coin-changing machine introduced by a New York City rapid transit company. Without the aid of an attendant, it is said to change dimes, quarters, and half dollars into mckels more rapidly than any human change-maker could do it

The photograph below shows Frank Hediey, president of the transit company, demonstrating one of the machines which, he says, eventually will be installed in 800 subway stations in which about 1200 attendants now are employed

Simplicity of operation is one of the valuable features of the machine. At the



Demonstrating the automatic only change

top are three slots, marked 10, 25, and 50 cents. Above these in the instruction "Insert money here." When the specifical coin is deposited, the correct change for it is deposited automatically in a corresponding receptable below

Beneath each slot is a lens that magnifies the deposited coin four times, so that the coin may be seen both by passengers and by the attending guard. This is to aid in the detection of slugs or counterfest coins.

\_\_\_\_

#### An Automatic Nailer

GREATER speed and convenience in nathing roofing is provided by a device that automatically places nails up to 115 inches long in position to be driven in

The machine consists of an iron frame holding a nail box from which the nails are fed down an inclined carrier

A catch holds each null in position for hummering.



Laying recting with the nail mathins

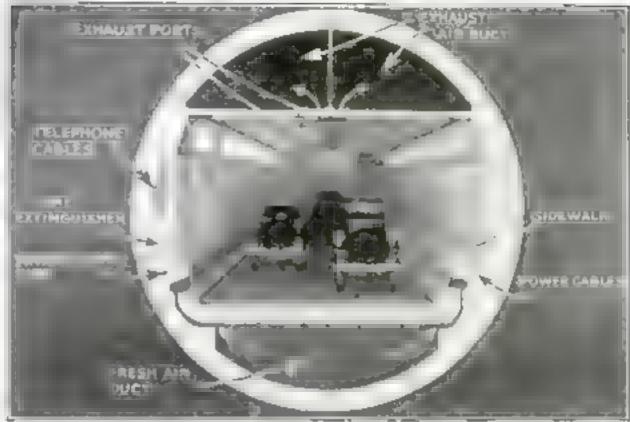
#### Miniature Tunnel Built for Lighting Tests

TO DETERMINE the most effective way of lighting the twin vehicular tunnels now being built under the Hudson River, engineers of the Westinghouse Lamp Company recently constructed a miniature model of a tunnel section, complete to the tiny automobiles representing vehicular traffic.

Ample light without either glare or sharp shadows wan the desired goal. After numerous experiments with the model, specially designed reflectors were set in iron boxes embedded in the wall on each side near the criting, the light being directed downward at an angle of 20 degrees. With the addition of diffusing glass covering the reflector mouth to prevent glare, this arrangement solved the problem.

Two thousand of these special lighting units will be used, spaced at 20-foot intervals. Liumination three times greater than that on the average city street at night is said to have been achieved.

The model is on a scale of one inch to one fuot. It represents a tunnel section 120 feet long, being itself 10 feet long and 29 inches in diameter. The exact intensity of light to be used in the real tunnels is used in it. Signs around the mouth of the model explain the engineering fea-



Great-stellan of model vehicular tunnel, showing lighting, ventilating, and conduit systems

tures of the tube, cluef of which is the ventilating system.

This, designed to meet the special difficulty of exhaust gas, supplies fresh air through flues from a large duct beneath the roadway and removes vitiated air through ports to an equally large duct shove the roadway

Each of the twin tunnels, one for east and one for west traffic, will have room for two parallel lines of automobiles, the roadway being 20 feet wide. One sidewill be for clower vehicles, like trucks Each tunnel will be 1% miles long. They are expected to be ready for use early in 1926.



#### This Simple Pocket Catch Safeguards Your Watch

A CATCH with two tiny metal fingers secreted at the top of the tromers watch pucket has been devised to guard timepieces from slipping out and dropping to the floor when the trousers are hung upside down

A neatly concealed spring base plate in .nserted on the inner side of the watch pocket. Spring fingers run along the top of the pocket and meet at the center, closing over the watch chain. When the watch is in place, it is securely beld in an upright position so that the trousers may be shoken and folded without any danger that the watch will fly out and crash to the floor

When the watch is to be removed, pressure on the inner spring separates the fingers far enough to permit the chain to pass through. This can be done quickly, with a simple movement of the fingers.

# Ornamental Telescope for Lawn or Garden

A BRONZE reflecting telescope permanently mounted for home use and possessing beauty of design that harmonizes perfectly with a garden or lawn setting, how is available for persons who have made or would like to make the

have made or would like to make the study of the stars their holdry. The instrument also can serve as a sunched

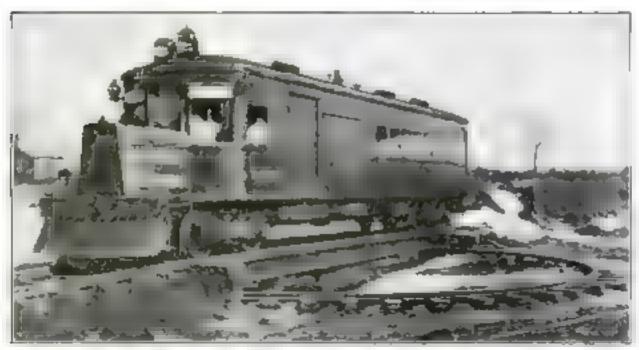
The conventional tel sent and must be taken down or the indoors when the event is stronght out again, it must be set up on its tripod and carefully adjusted. The new garden telescope, on the other hand, is a permanent fixture on the lawn, always ready for use

The tube of the usual telescope serves solely to hold the prism and eyeplece rigidly in their prism are relation to the concave mirror that catches the light. In the

design, the mirror is on a decorated hollow hemisphere, leadfuled for counterpoising. A curved, solid arm, carrying the prises and eyepsece, ascends from the hemiaphere. This swings freely on trun-Thus the re-DJOUR. flected light passes through free air to the prism. An additional eyepiece allows observation by two persons simultaneously.

The telescope is swung between its supports within a hollow member resembling an upturned bell Part of this bell is cut away, permitting the arm to swing so that any part of the heavens can be observed.





## Surface Turntable for Railway Motor-Cars

THE increased use of gasoline motorcars for passenger service has created a need for turntables at many points where there are no shops or facilities for turning cars.

To meet this need a special turntable has been devised that needs no pit under ordinary conditions, and that may be moved sasily whenever desired. This effects a reduction in cost and installation.

The equipment consists of a circular foundation call on which rides the turning section supporting the tracks. The distance from the top to bottom rail is only 21 1/2 inches. The outer wheels on which the table runs are equipped with roller bearings.

The table may be installed at any convenient point at small expense, it is claimed, and can be moved readily.

# Workmen Walk across Great Hudson Bridge

CONSTRUCTION of America's greatest suspension bridge—The Bear Mountain bridge across the Hudson—

had progressed to a point where workmen actually have walted from shore to shore the s

The great project will be the first bridge across the river between Poughkeepsle and New York City. Its total length will be 2252 feet, including approaches.

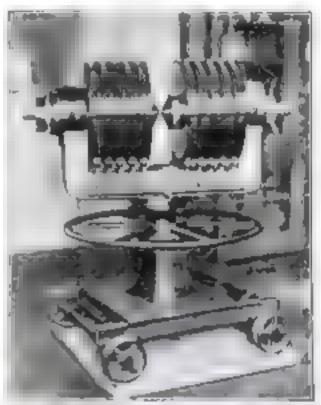


#### Most Powerful Magnet Used for Experimental Work

THE most powerful electric magnet in the world, used in connection with wireless research, has been installed in the laboratories of the University of Strasbourg, in Alsace. It was constructed upon the calculations of M. Weiss.

When the magnet is in operation, the strongest man would be unable to pass a steel butcher knule through the air between its two poles.

The apparatus is equipped with numerous adjustments that adopt it to a wide variety of uses in wireless experimental work, and is mounted on a wheeled truck so that it can be moved from place to place in the laboratories,



The world's most powerful nearest

### Hearing the Printed Word

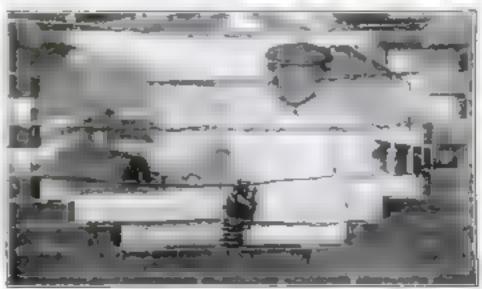
BABED on a principle similar to that employed in the telephone, a new device for making the printed word audible has been invented in Germany. The second to be in modifying printer's and a tenductive of electricity in

of paper, symbols that are very relation Morse detended when the first of the first of the second of

# Brick Walls Reinforced by Layers of Wire

To interior to between every second layer of bricks

As each layer is completed, wire in stretched along the top, and on this is spread the mortar for the next row.



Strips of spinispecing wire laid between the sown of bricks

View of the two temporary spans, showing the great size of the project.

#### Valuable Documents Copied on Film Negatives

MACHINE for copying letters and other documents without subjecting them to the scrutiny of outsiders has been developed to give instantaneous photographic records of any letter-size papers, dentifying them so as to make them admasable as legal evidence

A miniature film negative of motionpicture size is used. Documents are placed under a glass illuminated by sperial reflectors. Pressing a button starts a motor that moves a section of film before the lens, exposes it and moves it on to make way for another picture. Any number of pictures thus may be made of

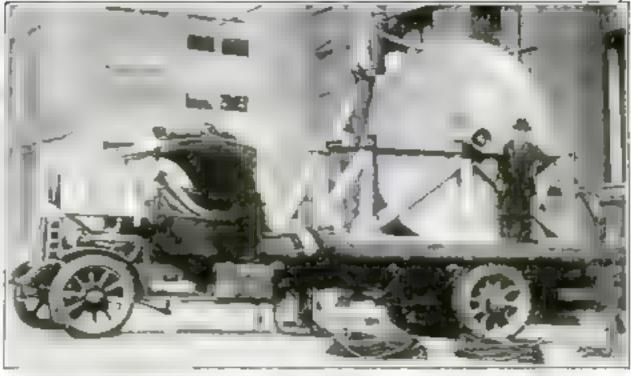


Photographing papers with film machine

any document. The ministure negatives then are developed and enlarged

Each document is positively identified ry means of a special arrangement at the top of the giam that holds the paper being rapled. This consists of three bands of fragmentary geometrical designs and a serial number, the bands and serial numher automatically changing with the hanging of documents

The bands move in opposite directions at different rates so that each document copied has photographed with it a record of the serial number and a different deeign, making counterfeiting impossible.



## World's Largest Belt Weighs Seven Tons

THE largest belt in the world was made recently for a concern in New Jersey The belt is 1550 feet long, 36 inches wide, weighs seven tons, and cost \$1000 a ton.

It took 12 workmen more than three bours to wind it on a reel more than nine feet in diameter. The illustration shows the belt wound on the reel.

#### A Push Releases Automatic Door Check

NEW automatic door check is so designed that one push on an open door festens it and a second peak in the same direction releases it

At the base of the door is fastened a

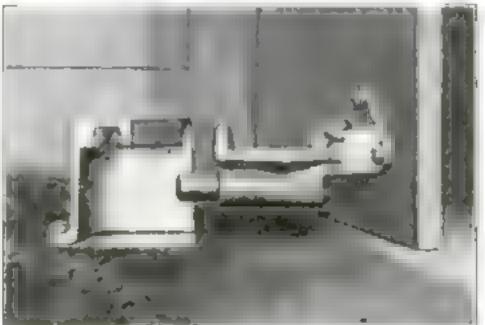
hook connected with a spring plunger or balt, which extends slight y in front of the bnok

A base plate screwed into the floor cortains a slot to catch the hook

> and hold the door open.

When it in desired to close the duor, a second comprisees pands the plunger and a lows the book to move into a chantel of the blue plate. This disonguges the hook so that the door may be closed again.

While designed primarily for use in railroad cars. device ndaptable also to garages.



The floor plate, bank and built

# Road-Finishing Machine Driven by Two Men

HAND-OPERATED road-tambing and -finishing machine, said to finish concrete roads as autisfactorily as motordriven machines, has been developed for

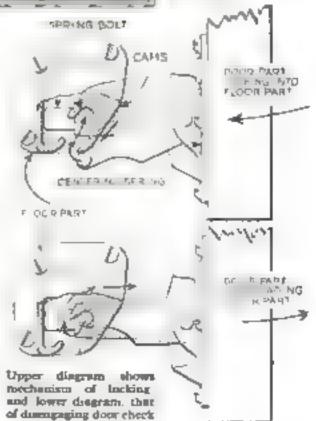
use by contractors. moves on two tracks that constitute the form for the concrete. A shaft extending across the top of the machine

> is turned by two men, one on each ride of the road.

> Through the action of a cam, the tamper is given both vertical and lateral motion, insuring a perfect crown. Two strike-offs, a tamper, and wood-finishing belt, passing over the plastic mass leave the surfacing smooth and with the desired grown to the road.



The machine runs on tracks that serve as the form



# Shall We Add a Thirteenth Month?

# Radical New Calendar Advocated to Simplify Calculations

N JANUARY 1, 1928, it is possible that the world may begin to live by an entirely new calendar, a calendar in which a year will consist of 13 equal months of four weeks each, and in which the same date of every month always will fall on the same day of the week

Such a revolutionary revision not only is being considered by a special committee of the League of Nations, but also has been urged in recent resolutions passed by the American Meteorological Society at Washington, D. C., where it was

actively supported by Dr. C. F. Marvin, chief of the United States Weather Bureau. He declares it would greatly simplify the collection and study of weather data.

The year 1928 is advocated on the most favorable time to start the new exlender, according to Doctor Marvin, since that year begins on Sunday Consequently the first day of each of the 13 months would fall on Sunday

REFORM of the such a new thing as It may seem. It is as old as the history of man. For centuries efforts have been made to improve the calendar so that it would coincide with the astronomical year-that is the time required by the earth to complete its journey about the sun and so afford complete unity between man's and nature's reckoning of time

The ancients had many calendars, all of which were innecurate and no two of which were alike to correct the resulting confusion, Julius Caesar initiated an important reform—the Julian calendar. This gave the civil year exactly 365 days, or nearly a quarter of a day less than the astronomical year, which is 365 days, 5 hours, 48 minutes, and 45.9 seconds. This discrepancy was corrected every four years by adding an extra day to February, creating the bissestile or leap year.

But over an extended period even the Julian calendar accumulated discrepancies, which in the time of Pope Gregory had reached the extent of 10 days. Radical corrections resulted in the Gregorian calendar which, so far as length of the

#### By Truman Stevens

calendar year is concerned, probably is as nearly perfect as possible. Yet while it is the standard calendar of today, the result of its method of dividing the year into months of various lengths is that no two consecutive months or years begin with the same day of the week. For this reason a calendar dividing the year into equal, corresponding parts has been sought.

A solution in the form of the 13-month calendar was worked out not long ago by a French engineer. It is called the "Delacontain the same number of workdays, the same number of days of rest. It is a modification of this plan that is being advocated for 1928.

EXPONENTS of the plan may it would be of great benefit to labor. All calculations of income and expenses would be unified. As it is now, the laborer who is paid a fixed wage a month works only 24 days in February while in other months he works 25 or 26. Under the new calendar the working must would receive the same monthly wage for the same amount

of work. The annual wages would not be smaller, because the men would be paid for 18 months instead of 12 and the aggregate would be the same.

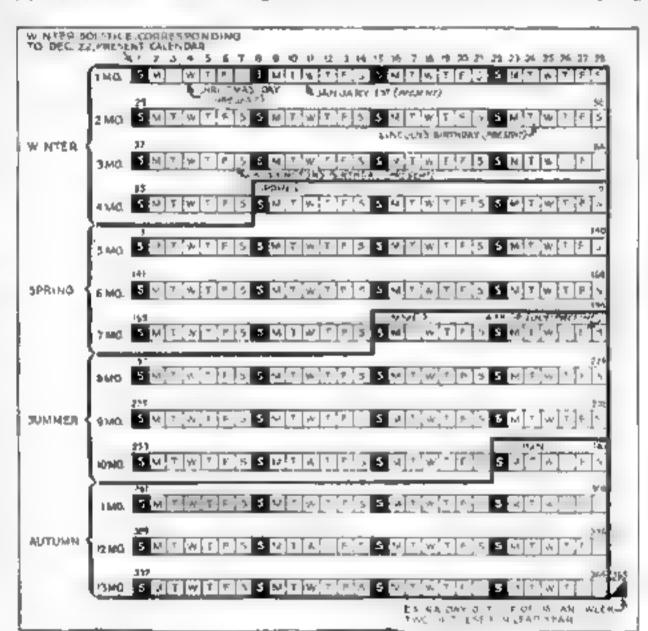
From the point of view of religious observance the new calendar would offer many advantages. The movable feasts, Laster, Ascension, Pentecost, always would fall on fixed days, and the immovable holidays always would fall on the came day of the week

For example, assuming that the first day of the year (corresponding to the present December 22) would be Sunday, our Fourth of July would fals every year on Friday, the twenty-seventh day the seventh month. The present Christmas Day would fall on Wednesday, the fourth day of the first month, and the present New Year's Day on Wednesday, the eleventh day of the first month

The new calendar undoubtedly offers many advantages—an exact solution of a world-old problem. But will the world ever accede to the great change that would be necessary to conform to it?

The committee of the League of Nations that now is considering the calendar reform, includes representatives of the world's great religious, scientific, and industrial organizations.

America's representative on the committee is Willis H. Booth, of New York, president of the International Chamber of Commerce. The conferences are expected to result in definite recommendations to the League. Action by the League would be followed by legislative proposals to the various governments.



The Delaporty calender, showing how the year beginning at the winter saletice, would be divided into 13 equal months of four weeks each with an entra day for Hew Year. The

ın leap year

year also in divided into four equal mesons of 13 weeks. Notice how the same date of every month falls on the same day of the week. The positions of present holidays are indicated

porte calendar," after the name of the inventor. For the purpose of equal division, Delaporte would take a year of 364 days, the extra 365th day becoming New Year's Day. Then he proposes to divide the year into 13 months instead of 12, each month to be composed of four seven-day weeks, or 28 days. An extra day would be added

Since 13 months cannot be divided exactly into four equal parts, Delaporte would divide the 364-day year into four seasons, each containing 13 weeks. The first day of the year would be fixed at the winter solstice—the shortest day, corresponding to December 22 of our present calendar.

Every month in every season would

which is quickly attached to the oven wall by a single acrew, and which plugs into an ordinary electric socket. The heater may be used also for fireless cookers, clothesdriers, bed-warmers, and water-heaters

# Applied Science in the Household





#### Swinging Pendulum Warns at Grade Crossing

PRESNO, Casil., has augmented the usual railway grade-crowing sign by the installation of an electric warning post in the center of the street.

A pendulum hung from a frame at the top of the post, swings continuously, calling attention to motorists of the presence of railway tracks.

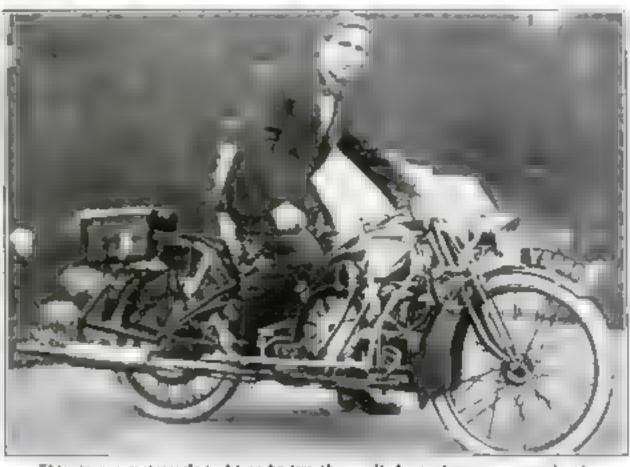
On the swinging pendulum is a "Stop" sign for daytime warning, and a red light that flashes a danger signal at night,

The supporting column is well lighted to prevent the possibility of a motorcur's colliding with it

# Odd Motorcycle Is Driven by Twin Engines

A SIX-CYLINDER motorcycle consisting of two separate three-cylinder engines, one on each side of the frame, is the unusual invention of a British motorcycle enthusiast. The engines are four cycle and together are rated at 16 horsepower. Each have magneto and carburetor, and are cooled by vertical fans.

Mechanical lubrication with sight fred, and chain transmission with three speeds are used. There are shock absorbers on the front forks, two gasoline tanks, speed-ometer, clock, a gradient meter and gasoline gage. A small tank under the seat carries reserve fuel. Brakes are installed on front and rear wheels.



This strange metercycle is driven by two three-cylinder engines, one on each side

# Service Station Has Safe-Deposit Boxes

TO PREVENT loss of tools or other personal belongings from cars left for repairs, a Brooklyn, N. Y., service station

other has provided a series of large metal left for boxes, or lockers, into which articles station left in the machine are placed. The

owner is given the key and an identification check

The lockers are stured in racks in A special vault. The sent cushions of the cars likewise are checked and stored on shelves above the lockers to prevent any possibility of their becoming soiled and stained by grease and oil while mechanics are working on the eutomobile.



#### The Origin of Paved Roads

Other be said to have originated e highway of England of Joseph Aspdin, a figured discovered that tone coads was mixed at a high temperator mans when ground we a material that hardened was agree.

The state substance looked a stone quarried at Portland, because a mixed brains with his mortar, as the state of street roads today.

#### Water Vaporizer Designed to Eliminate Carbon

A SIMPLE water-vapor device connecting the radiator and intake manifold is designed to prevent carbon formation in automobile cylinders and to dissolve old carbon deposits.

It consists of a connection to the water ducharge pipe near the radiator, an automatic valve installed in the gasoline intake manifold, above the butterfly valve, and a length of small copper tubing joining the two fittings.

Through four small holes in the body of the automatic valve, air is mixed with



Arrows indicate redictor menifold connection

the water in order to vaporize it. The water is taken from the circulating system so that no extra tank is necessary, the amount being regulated automatically by the speed of the engine. It is shut off automatically when the engine stops.

The distinctive feature about the device is its simplicity,

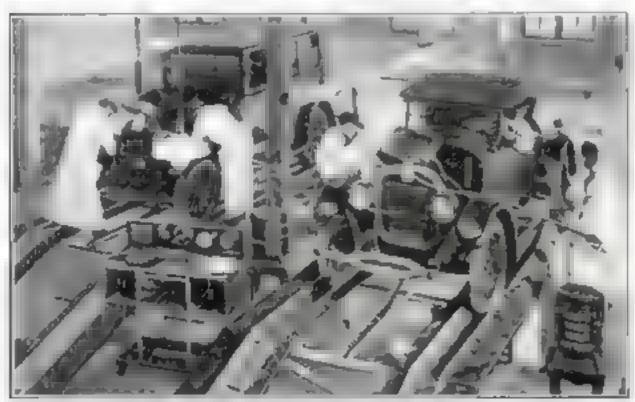
# Worth of Used Cars Tested in Laboratory

CHICAGO motorists, at least, now en-joy the prospect of being able to buy used cars with a rehable certificate of full value for their money

This has been made possible by the establishment of a huge new testing laborates in Chicago, under control of the Attemobile Trade Association, compris-

factors are determined accurately by chemical tests. The final step is a careful examination for defects in the chases, springs, or mechanical parts. Should any of the parts have beated under the loads, this examination reveals it

If the car stands up under all the probing, the laboratory usues its O.K.



Testing used cars in the Chicago laboratory to appure protection to the purchases

ing the used-car dealers of Chicago in its membership. The laboratory is prepared to test about 100 cars a day, and to give every car a combing over that will leave absolutely nothing uncovered in the way of defect that may harass the purchaser

The first step in the tests is a sort of 'registration" of the make of the car, type, and model, and the specifications a car of its age and type should meet.

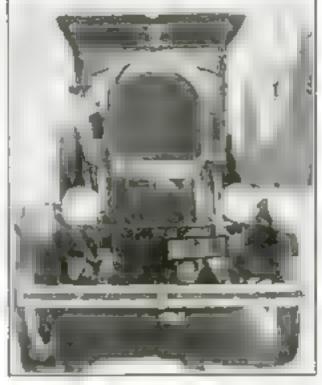
Then the car falls into the hands of expert electricians. First, the buttery and starting motor are tested while the starting motor is turning the engine. The performances of the hattery and motor are compared with standards. With the engine running, the electricians then check the generator output as well as the cut-in and cut-out points of the regulator. An unduly high or low charging rate is detected

SPARK pluge and ignition are tested by means of a grounding gap. This test tells also whether the plugs are set properly and whether they are fizing as they should. The engine then is stopped while a careful examination is made of the breaker points and the ignition unit. If the car "power," its future owner may be sure the ignition system will function properly.

In practice, a test of all electrical equipment is completed in less than 16 minutes. The car then moves along to the Wasson ho.sepower-testing stands. On these stands the automobile runs under its own power with its rear wheels turning on friction drums. A pony brake. operating on the drums, determines horsepower delivered at different speeds and the twisting effort, or torque.

Meanwhile examinations of fuel consumption and piston leakage are made. Also a sample of the cylinder oil is drawn from the engine base and the amount of water, dilution, and other chemical

Thereafter any buyer may be sure that when he takes the car on the open road, it is likely to give satisfactory service.



#### Novel Car on Stilts Offers a Bird's-Eve View

TO ATTAIN the utmost in novelty motoring and incidentally a bard'seye view of the scenery, a Los Angeles man put his car on stilts by raising the body several feet above the chassis and extending the operating levers the necessary distance. Now he is able literally to look down on every one.

While the appearance of the car is grotesque, it is operated the same as any other automobile. Its chief drawback, of course, is the long chimb from the ground.

### One Man Runs Combined Tractor and Grader

OPERATED by one man, a new combined grader and Fordson tractor now coming into use on hundreds of reads throughout the country, is said to cut the cost of readmaking and maintenance enormously. No teams or extra

electric steel castings and heavy steel sections.

The grader can be assembled, it is claimed, within an hour. No holes need be drilled. Disassembly is said to be at least as easy, permitting the tractor to be

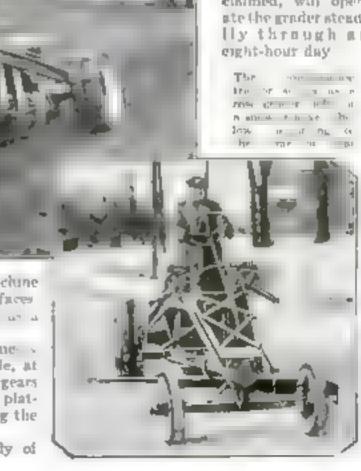
used readily for other purposes when needed for them

Two quarts of oal and 15 galons of gusoline, it is claimed, will operate the grader steadlly through an eight-hour day

warm an required and the machine a star to the roughest surfaces I was a second a tree or a AT A SE THE STATE OF THE

The grader blade can be raised quie . . and lowered or swung to either sade, at any angle. The tractor clutch and gears are manapulated from the operator's platform by hand and foot levers, giving the case of automobile control.

The grader is constructed largely of



# Maughan Proves U. S. Airway Possibilities

SIDE from its scientific and . commercial, significance - demonetrating as it did the marvelous capabilities of the modern airplane, and possibly speeding the arrival of the time when passengers and freight will : is carried through the air an readily as they now are transported by rallway, ship, and motor-car the recent feat of

Lieut Russell L. Maughan, U.S. A., in flying from New York to San Francinco between daylight and dark, stance forth as one of the most daring exploits of all time

No glory is taken from Maughan's achievement by the fact that more than a year ago Lieuts, J. A. Macready and O. G. Kelly accomplished an Atlantic-to-



Lieutenant Maughan and his plane at the end of his transcentional flight

Pacific flight without descending from the air-still the world's record non-stop Ilight. On the contrary, the conditions under which the flights were accomplished

were so decidedly different that Maughan's feat becomes all the more remarkable.

Maughan's girplane was a Curtina Other-seat pursuit plane, designed to remain in the sir for nuly about three house. It was exactly like 25 other planes now being constructed for the army air service No change was made in body or mechanism in preparation for coast-to-coast flight, heyand providing additional gasol,no storage space.

The plane used by Macready and Kelly was the army trans-

port type-a large, comparatively slow craft. It was balanced and operated by natomatic devices, making it unnecessary for the pilute to do more than steer it.

Maughan, besides being alone, was forced to exercise constant vigilance And so for the 21 hours, 47 minutes, and 45 seconds that elapsed between his take-off at Mitchel Field, N. Y., and the time of his landing in San Francisco, Maughan was constantly on the job.

#### MORE than that, he was sick for virtun ly every second of the 18 hours, 30 minutes, and 45 seconds that made up his actual flying time. Specing through the rarefled upper atmosphere at an average rate of 154 miles an hour for 2850 muss. Maughan was afflicted with a viofent nouses, an enervating, discouraging illness that aviators describe as being akan to semickness. The only respite Maughan had from his illness was during the three hours and 17 minutes that he spont on the ground while his gasoline was being replenished and minor repairs were being made on his machine. Despite this, though, be persevered, bettering the time of Macready and Kelly by five hours and 36 minutes, winning all the laurels that rightfully belong to the first man to fly across the American continent alone and unaided in a single day.

Maughan's flight, however, was to mere feat of physical endurance. It was a test arranged by the army air service of the mobility of this country's air fleet And from a military standpoint, Maughan's personal glory is secondary to the proof he gave that in time of necessity the air forces of the I rited States can be mobilized in any section within a day

And while army officers were dwelling on this thought, the Post-Office Depart ment inaugurated its coast-to-coast au mail service that takes letters from New York to San Francisco in 34 hours and back in 32.

These two epochal events, occurring within a few days of each other, surely point the way to the tremendous possibilities of aviation in the next few years.

### Wind Tunnel Used in School of Aviation

FOR scientific experiment in the design and construction of airplanes, and for the study of wind premure and velocity in relation to the lift and resistance of uirplano wings, a wind tunnel recently has been added to the mechanical equipment of the accodynamics department of New York University

In the tunes in panel a TOTAL BLILD . B. COM three feet long which peller driven by metar sweeps through the tube at velocitast up to 70 miles an hour the pressure and the wind are registed. extrament grown as a wind

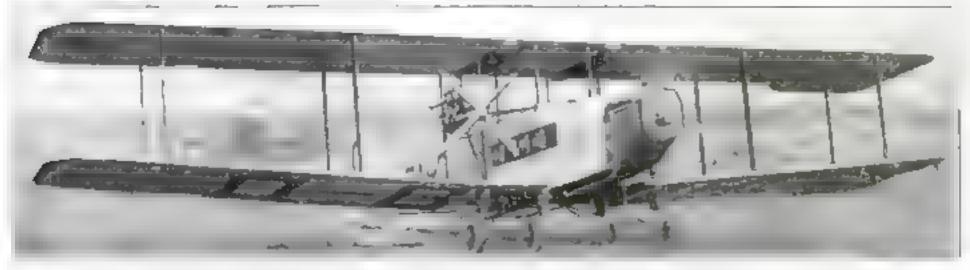
I mance, and the effects of the wird variations on the motio-· Was W & Geo .

read of the Department of Mechanical Engineering of New York University and Ihrector of the Popular Science Institute of Standarde, and Prof. Alexander Klemin, are in charge of the work being conducted with the new machine, which is the first of its kind. It is expected to sid greatly in giving students of the university a grasp of the fundamental principles on which the mechanics of aviation are based.

the Left The same

ment has press as of-





## Sturdy Triple-Engine Planes to Fly across Kongo Jungles

AIRPLANES are about to fly over the jungles in the Belgian Kongo. Africa, cutting a 45-day land journey to a two-day jaunt through the air

For three years the Belgian government has been conducting tasts to perfect the new type of plans shown above, capable of making the rigorous 1200-mile journey that virtually lies along the equator. The extreme climatic conditions cause a severe strain on the structure of planes in this area and landing-fields along the route are practically nonexistent.

The new type plane therefore will be equipped with three engines, a 250-horsepower Rolls-Royce in the nose of the fuselage, and two 230-horsepower angines on the wings. Should any one of the engines fail, the plane still can hold the air

and reach Ita destination The frant engine alone is capable of flying the ship if it is not loaded with its full complement of freight.

The wing span of the machine is 75 feet; the length of plane, 60 feet, and the height 17 feet. Accommodations for 10 passengers and 1000 pounds of luggage will be provided and the flying speed will be more than 100 mires an hour



#### This Camera Takes Photos at Record Height

LONG-DISTANCE nertal carmers A of the type with which Lieut. John A. Macraudy, test pilot, and A. W. Stevens, aerial photographer, recently took pictures of Dayton, Ohio, from a beight of nearly six miles, will be part of the equipment of an expedition scheduled to go 3000 miles up the Amazon River. With it the first merial photographs of the mighty river will be made.

In photographing Dayton, the giant camera registered clearly objects on the ground invisible to the sirmen. Captain Stevens is shown above with the camera.

## Smoke Screen Hides New York Skyscrapers

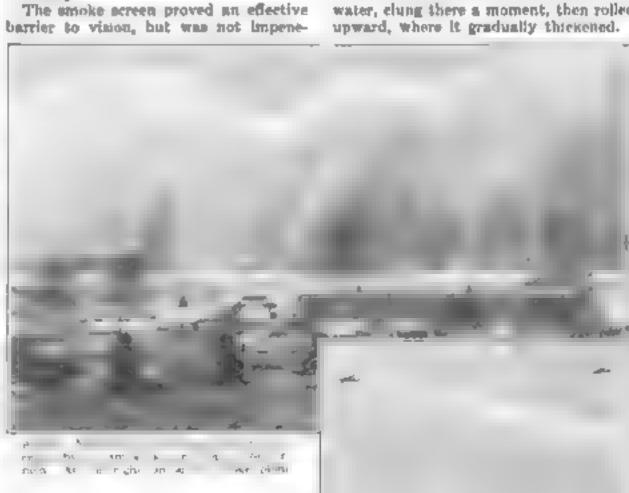
UNCLE SAM'S army flore recently gave New-Yorkers a thrill when they blotted out the lower and of Manhattan by dropping a smoke ecreen over that part of the city from surplanes equipped with special chemical apparatus.

The serval demonstration was conducted under the direction of the Chem-Ical Warfare Service and the Army Air Service to gage the possibility of screening America's largest city from the attacks of an enemy

trable to "enemy airplanes," which flew through it easily.

Varying in color from white to greenish white, the acreen was laid down by two tanks under the body of each plane. The tanks contained titangum tetrachloride and carbon dioxide, and both ducharged their contents through a common outlet at the tail of the machine.

Air contact vaporized the chemical combination, which dropped rapidly. In the test the amoke fell until it struck the water, clung there a moment, then rolled



#### Danger to Aviators The Mirage-A New

NEW peril of long-distance flight A was revealed in a recent statement by Maj. Frederick L. Martin, who was commander of the round-the-world flight of United States Army planes, and whose machine crashed against a mountain peak in the Aleutian Islands. He ascribed the miship to a mirage that changed the apparent face of his surroundings.

A mirage is a picture in the air caused when light rays carrying an image are bent by variations in the atmosphere's density. Such distortion may entirely to with a flier's judgment of distance



# Twenty-Foot Trench Forms a Natural Silo

AN ENTERPRISING farmer at Tucson, Aria, put into use an unusual mic that might be dual cated by other farmers. He excavated a treach about 20 feet wide and deep and 800 feet.

long. The sitage was packed to the earth's surface and covered with two feet of clay -a method that is said to keep the sitage in as good condition as with the most elaborate modern miles.

Fire Truck Has 100-Foot Extension Ladder

NEW YORK CITY'S newest firefighting equipment consists of a 100foot extension ladder that folds up on top of the motor-truck that earries it. Mechanism at the base makes it possible to turn this huge ladder in any desired position and to extend it upward to a height of neveral stories of a building with extraordinary rapidity.

#### Electricity Employed to Make Plowing Easier

AN INGENIOUS electrical method for making plowing easier has been invented in England.

A large part of the work done in plowing is "wasted" as friction between the mold-hoard and the soil. The idea is to use the soil mousture to lubricate the moldboard

By insulating the rolter of the plow and passing a current from it through the soil to the moldboard, the water in the soil is caused to move to the moldboard.

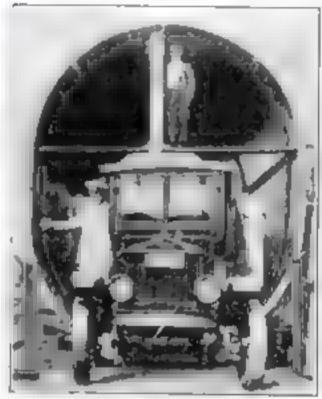
#### Motor-Truck Can Drive through Huge Stack

SO HUGE ere the new amokestacks installed on the transpacific liner, City of Los Angeles, that a motor-truck can drive through one of them with plenty of room to spare.

These bage funnels are part of \$1,000,000 worth of new equipment for the famous steamer that pless between Los Angeles Harbor and Hopolulu.

The diameter of each stack is 17 feet 3 inches; the height, 37 feet, and the weight is 30 tons.

The illustration shows a truck driving through one of the stacks as it has on its side at a Los Angeles shipbuilding plant, waiting to be put in place.



A truck driving through the stack

#### Wigs Made of Glass Hair

PINE threads of spun glass, such as in used for sparkling timed on Christman trees, are being made into wags for women by a newly discovered process, which may set a new style.

# Roadside Barbecue Feeds Hungry Motorists

THE latest idea in barbecuing is a roadside fireplace and grate erected by a Cincinnati man along the Lincoln Highway, where he supplies motor tourists

with fresh hot sandwiches or roasts right off the fire.

The meat is placed before the fire on a steel apit that is rotated by a small electric motor connected with it by a belt and pulley. A trough below catches the mest sinces. All the operator has to do is to start the motor and dup up the juices from the trough to baste the meat. Gas or charcoal is the fuel used for reasting. The originator of the idea is R. W. Wiggins, who is shown in the picture, and it is said that motorists are giving him every encouragement.



The spaduide burbecue, showing electric motor that turns the spit

#### House Cut in Half to Make Room for Building

WHEN a power company in Manchester, N H., recently desired to put up a new repair shop, there stood in the way a house, one half of which occupied part of the proposed building-site. The other half of the residence stood on an adjoining lot.

When certain conditions made it impossible to move the entire house, the contractors decided to cut the dwelling in half and remove the half that occupied the building-site. After making a straight cut from roof to basement, they walled up the exposed side, as shown in the illustration.



View of house after the operation

#### Electric Sign a Block Long

TILE world's largest electrical advertising sign now flashes out the merits of a brand of ginger ale from a building in Times Square, New York City. The sign extends for an entire city block and is 68 feet tall, almost equal to the height of a six-story building.



#### Ornamental Lamp of Cord Made by a Sailor



THE first lamp made entirely of cord recently was exhibited in a New York hotel. This unique lighting fixture took a year of labor by a Spanish sailor, Juan Rios Rivers. It was said to have been made for a beautiful girl Rivera fell in love with after he had rescued her from death by drowning.

a bookense and that can be moved from place to place on easters, recently was patented by an architect of Washington, D. C.

When folded, it resembles in anpearance an old-fashioned folding bedstead. When it is to be opened for a meal, the central panel swings downward to rest on a hinged support. Two side panels also swing downward and unfold to form two benches, each of which will seat two persons.

The opening of the panels exposes a dozen shelves for dishes and the table linen; also two drawers for silver. The table may be used for an ironing-board if desired. It is claimed that this novel dining-room can be handled by a child.

# Complete Playhouse Has Electric Lights



The small hestess "at home" to her friends in the playhou

ONE of the latest attractions at Vancouver. B. C., is a child's playhouse that is a perfect model of a "grown-up" including bouse. real election lights. furniture, kitchen and dimng-room equipment, porch. lawn, shrubbery, and all the rest.

The miniature home was built by Capt. W. Simpson for his azma |} daughter. The young housewife is above officiating at a formal "at bome" for her little friends.



Making a cut. Notice the ingenious curriage on which the onphydrogen torch is guided

# Shaft in 10 Minutes

HUGE generator shalt of sould steel weighing 40,000 pounds and measuring 27 inches in diameter recently was cut through five times by a torch in the remarkable speed of from 10 to 17 minutes for each cutting

Owing to the Interne heat encountered in such heavy cutting and the consequent punishment to the operator in attempting to manipulate a torch continuously for the length of time required to complete a cut. an ingenious device was rigged to carry the turch at the required uniform speed up and over the shaft as the cutting progressed.

The device consisted of a pipe framework erected over the horizontal shaft and supporting two 11-inch parallel steel rails laid six inches apart horizontally across the shaft and three feet above it

The oxyhydrogen torch was fastened to a carriage traveling on these rails and propelled by hydraulic pressure from the oxygen line. Vertical motion was obtained by another device clamped to the torch and carriage, the speed of which was controlled by a water piston, as shown in the inset above.

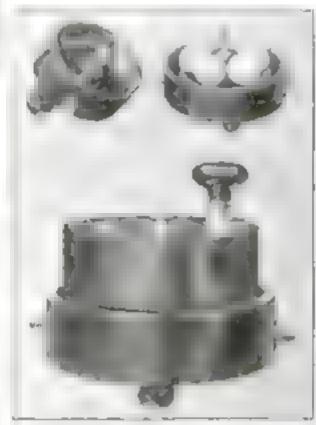
hight cylinders of exygen were connected with a manifold on the high pressure side and the oxygen was delivered to the torch through four manifold regulators. The gas consumption was 600 cubic feet of hydrogen and 2000 cubic feet of oxygen an hour

The shaft was cut for use as material for making drop forgings.

#### Machine Cleans Six Tennis Balls at Once

MACHINE for cleaning soiled tenris balls consists of an airtight cylindrical box in two sections. The balls are placed in position in the holder, a soup solution is applied to each ball, the cover is attached, and while a handle rotates the basis, water is run through connections at the base, forming a lather

After washing, the machine is drained the cover removed, and the balls are allowed to dry



Tennis-ball cleaner open and closed

#### Belgian Mine Shafts Sunk in Columns of Ice

IN ORDER to mine rich coal beds in Beigium that were practically insccomble by marsh land lying over them, engineers devised a means of sinking the shafts in columns of ice. Two such shafts already have been sunk approximately 2500 (set at a cost of more than \$1000 m foot.

The system consists of freezing portions of marshland in the form of cylindrica. columns of ice in which the shafts are sunk. To do this several holes about a yard apart are drilled in a large circle around the proposed shaft. A verticapipe sealed at one and then is sunk in each of these bules and a freezing solution of salt run through them, forming around each pipe a zone of frozen bog that spreads until it joins zones of adjoining

The refrigerating machines used are based on the evaporation of liquefiable gases, such as ammonia and carbon These are compressed and d: oxide. liquefied in calls of a condenser that are kept cool by passing water over them continuously The liquefied gases then pass through refrigerating colls over which the freezing liquids circulate. As the gases evaporate they create intense cold, freezing the water around them.

Seven months were required to freeze the first shaft and 22 months to sink the shaft at a rate of little more than three feet a day.

# How Much Science Do You Know?

DID you ever stop to think how much success in your business or profession depends on a working knowledge of simple scientific facts? In the shop, the factory, or the office, have you observed that the man who always is ready with the correct saswer when a question is put to him in the man who is in line for advancement?

The practical knowledge that leads to larger pay envelopes and greater independence is the knowledge of scientific facts in their uneful-

How much resence do you know?

Below are a dozen questions chosen at random from hundreds of querier from Popular Science Monthly readers. Answer them to the best of your abmity, then turn to the correct answers on page 132 and see how nearly you are right. But don't read the answers until you have studied each question thoroughly

Another test of 12 questions and answers will appear in next month's

Why is it hard to run uphill and easy to run down?

What are vitamines?

- How did stars come to be put into constellations? Why is there no air inside an electric-light globe?
- Can energy be destroyed? Give reasons for your answer.
- Why does a giraffe have such a long neck?
- What is an echo, and how is it caused? How much does the earth weigh in tons?

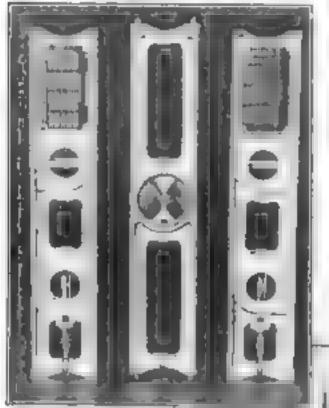
9. What is an electric current?

- Can we see atoms of matter with a microscope? 10. What is the most valuable of all known metals? 11.
- 12. What is it that makes a person feel hungry?

#### Improved New Level Made in Three Sections

AN IMPROVED 48-inch level of aluminum is made in three 16-inch sections that dovetail together and are so are a fustened by thumb-screws. When taken apart, the sections fit into compartments in a leather case. The entire width weighs only four pound

he level indicator Variations are show to degrees on a dismark As the level =



Above. The three sectons if we are free! showing indications disk opent level descripplumb, and calculating table. Right The hereby carrying case



## Workmen Hoist Selves on Aerial Scaffold

TO REPLACE the cumbersome and sometimes hazardous scaffolding, tackle blocks, and sigging ropes used in astruction work a French scale with a small platform on which a workman can how himself to any height required by his particular job

The platform runs up and down a vertical wire cable and operates on the wind assignmental By turning the crack of a winch the operator can rune or lower himself at will. A braking mechanism holds the car

stationary on the calle at any desired point, leaving the operator's has de free

The cable, suspended from a high point on the structure where it is to be used, was support three tone. A worker with his helper and their tools can be carried

Constructed entirely of metal, the invention is said to commute the maximum of safety with the minimum of effort

The illustration shows the invention bring tested beneath the Ediel Tower

#### Chinese Trees for Pulp

SFI-DS of Chances fir-trees, which are particularly suited for the manufacture of wood pulp, are being tried out in the United States by the Forest Service in the hope of adding to the nation's pull resources.

moved up or down, a weighted indicator across the face of the disk points out the degrees of variation. A table gives the number of inches rise to the lineal foot for each degree.

In addition, the instrument is equipped with a horizontal spirit level and a vertical spirit plumb. A V groove along the top of the level is used for eighting.

#### Recent Publications

Chemistry in the Twentieth Century. An account of the achievement and the present state of knowledge in chemical acience, prepared under the guidance of a committee representing the acientific societies of England, and edited by Dr. E. P. Armstrong, F.R.S. Rlustrated. The Macmillan Company.

Icerus, or The Future of Science, by Bertrand Russell, F.R.S. A pessimistic view of coming scientific achievement E. P. Dutton & Co.

A Magician among the Spirite, by Houdini. The story of a 30-year investigation of spiritualism told in a thoroughly engrossing way. Exper & Bros.

Automotive Repair, by J. C. Wright, director, Federal Board for Vocational Education. Four volumes of thorough practical instructions in every phase of automobile repair work. Illustrated John Wiley & Sons.

# Know Your Car

## Running the "Stiff" Engine

MOST automobile owners know that a new carefully and cautiously at least for the first 500 miles. But did you know that an overhauled engine should be run with equal care after it comes from the shop?

This is because an engine, after an overhauling that includes the fitting of old and new parts together, is in much the same condition, so far as friction is concerned, as when the new parts were assembled originally at the factory. It is "wiff," and demands care in running if it is not to be damaged.

A safe procedure for running the engine under such conditions is as fol-

Before starting the engine, fill the crankcase with half again as much oil as usual. Be sure that the radiator is filled with water and that the fan belt is adjusted correctly

To every gallon of gasoline add one pint of oil for the first 500 miles.

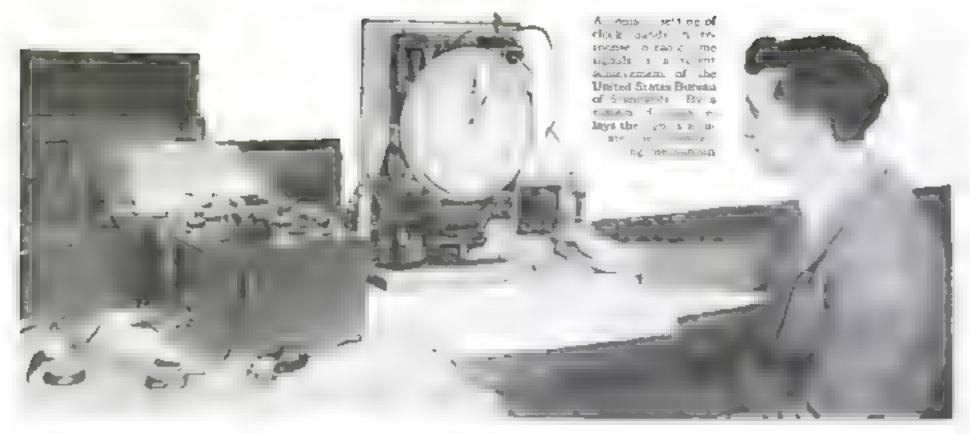
After starting the engine, inspect the oil pump to see that it is working properly.

To make sure that the upper parts of the cylinders, piston rings and pins are lubricated, shoot a small amount of oil from an oil gun into the air intake of the carburetor. Repeat this at intervals for balf an hour, or until the lubricating system is found to be working properly

If the water in the radiator shows a tendency to boil, run a hose to the radiator, and through this feed in cold water as fast as the hot water can be drained through the petcock at the bottom of the radiator

Let the engine run idle for several

For at least 500 miles do not drive the ear faster than 20 oy 25 miles an hour



# What's New in Radio Invention

By Jack Binns
America's foremost writer on redio

VILE the perfect budspeaker be produced this year? Ever since the advent of broadcasting it has been remixed that the 'speaker' controls the future of the science. In the United States, England, and France overy available effort is being concentrated upon the development of this limitrument.

Dr C. W. Hewlett an American scientist, has produced a new speaker that has no iron in it at all. Nother does it require a horn. It is based on the

viduction principle.

Instead of the usual born, it has an aluminum disphragm mounted in a frame and surrounded by flat coils of wire close to it. The coils carry direct current that produces a radial field over the disphragm, which in the largest model is thirty-six inches in diameter. The same coils carry the amplified voice currents, and the interaction between the currents causes the disphragm to vibrate.

THE present model, however, is suitable only for very loud work.

An entirely different method is being employed in a speaker developed in England. This is based on the electrostatic principle, developed by two Danish engineers. Johnsen and Rahbek. It involves the phenomenon existing when a semi-conducting body, such as gelatine, is brought in contact with a metallic surface, and a difference of potential maintained at the point of contact. This causes an adhesion between the two objects. Any change in voltage will cause a corresponding change in the degree of adhesion.

In the new speaker advantage is taken of this effect in the following manner. A metal cylinder is slowly rotated in close contact with a band of gesatine covered on the outside with tinfoil. One end of the gelatine is connected with a spring, the other with the disphragm of a loud-speaker similar in construction to the sound box of a phonograph.

In operation a steady voltage is main-

stoady adhesion between it and the gelatine, which maintains a steady pull on the disphragm. The pulsating current from the radio amplifier causes changes in the adhesion, and these in turn actuate the disphragm, causing it to give off sound.

In France most experimental work with speakers is being concentrated or large disphragms that eliminate the necessity of horns. It is recognized that the latter merely concentrate the sound

waves. They do not in any way amplify their volume; in fact, thry absorb some of the energy

#### The Hunt for Static

SCIENTISTS have come at last to the realization that the best way to eliminate the evil effects of stotic is first to learn its babits, where it comes from, and the hours it keeps. With an intelligent knowledge of these facts more progress can be made toward its elimination than by any of the haphazard methods at present employed

Somewhere off the New England coast engineers of the American Telephone and Telegraph Company's laboratories have installed an automatic recording device that makes a permanent record of the strength, duration, and direction of all static discharges within range of the sensitive apparatus.

In the short time it has been in operation two very important facts have been learned regarding the enemy of radio. First, it has been found that there is a marked decrease in the value of static every morning at sunrise, trrespective of weather conditions. Second, the observations have indicated that most of the static received on the eastern coast of the United States originates in the southwest. The conclusion drawn is that if a



For the first time is history speeches and entertainment have been broadcast from a steamer at sea. Above is a view of station WSN about the liner Levisitham, from which the program was sent. A radio supposer is seen testing the wave length of the station with a crystal set, preparatory to broadcasting

reflecting wall separates day and night, it follows that as this wall passes a station it will reflect or refract the static waves from the southwest and act as a shield to reduce the intensity of the static at sunrise.

The apparatus employed consists of a loop antenna that picks up the static. A loop is highly directional, and therefore indicates the direction from which the static is coming. The loop is retated automatically, and the energy picked up in this minney is passed into a radio-frequency ampafier. The output from this is fed, into the beating elements of a thermocouple that operates a recording galvanameter. In addition, the apparatus includes a means for measuring the intensity of the static noise.

#### Safety for Air Mailmen.

ON JULY first the new transcontinental air mail service was inaugurated. Rodio is playing a remarkable part in the safety of the aircraft employed

in this service. All the landing seems are linked with a ranto system that approximates in effectiveness the block system of signaling on radroads.

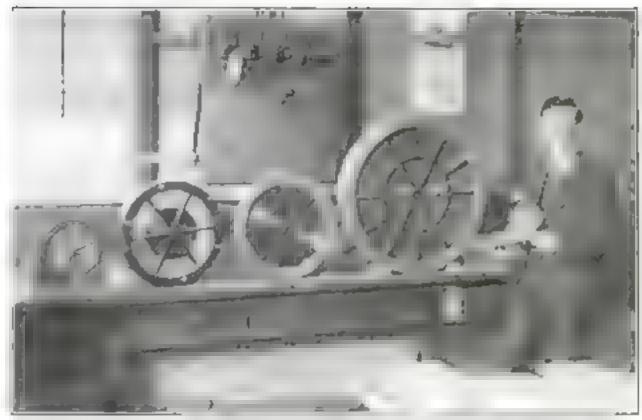
Ir a taken of remarks able of the safety measures, however, is the newly developed "rold loca izer". This conrists of an electric wave spread above the landing field somewhat in the abupe of an inverted cone. The apex of the



The base of one of the 10 largest wireless ments in the world creeted at Rugby Kagland. They will make it possible for London to telephone New York Ruch great mast weight 140 tone and to 620 feet tall

cone is on the landing field, and the base up in the air. With its aid, an airplane caught in a fog can be guided safely to a landing, because the "wave field," parrowing down to a cone, becomes more accurate as the machine nears the ground

The prior knows he is in the vicinity of the landing field as soon as he picks up the 'wave field" with his instruments. Then



Four different steed models of the latest in radio loudspeakers—the burnless induction loadspeaker developed by Dr. C. W. Hewlett, physican of the General Electric Company, who is shown above in his labourtury. The largest of the models 36 suches to diameter, has been installed near an auto-townstal company ground at Behaviorately N. V. and can be board 500 fort away, ansuring outertainment for a large audience

by carefully maneuvering his machine downward, he can reach an altitude where he will be able to see the landing field through the haze.

Direction findera also are to be installed on the transcontinental mir - mail shipe. These will enable a pilot to steer a straight course between scheduled stops should he be overtaken by unexpected foggy weather

There doubt that serial navigation and radio are bound together inseparably. In fact, without radio, organized flying on schedaled time-tables would be impossible.

View of the giant mass

#### Facts about Broadcasting

OME interesting figures have just been Some inverseling and broadcasting stations. Three show that 79.3 per cent of the stations beensed in this country are operating on less than 500 watts, an amount of power generally connidered inadequate. There are 94 stations with 500 watts outout, and 14 using more than that amount.

Another interesting analysis shows that 53.8 per cent are operated by radio and electric companies, dry-goods stores, newspapers, and other private corporations. Of the remainder, 17 per cent are worked by governmental agencies, federal, state and municipal, and 3.5 per cent by churches.

There is a strong tendency to bring about the elimination of the 79 3 per cent using less than 500 watte and to concentrate on the better type of broadcast stations strategically located with regard to centers of population.

#### Marconi's Remarkable Work

REMARKABLE progress apparently is being made by Marconi and bis assistants with the "directed beam" system of radio communication on wave lengths of one to 15 meters. The latest reports indicate that successful telephone communication between England and Argentina has been achieved. On this occasion the Argentinian Minister of Agriculture, Dr. Thomas Le Breton, who happened to be in England, spoke with War Minister Justo in Buenos Aires

As soon as Marconi's work has been brought to a successful conclusion, it will be possible to put hundreds of transatlantio radio-telephone channels (nto operation without interference, and with a fair measure of secrecy

#### Radio and the Railroads

RADIO probably never will suppose the existing systems of rainroad signaling and control autirely. It will, however, make possible direct communication at all times with moving trains. This is of far-reaching importance. Its value when storms disrupt the telegraph lines cannot be overestimated.

The Pennsylvania Railroad has just completed experiments with special stations erected at Camden, N. J., Pittsburgh, Chicago, and St. Louis. The results obtained with moving trains were very successful. The company now is considering the advisability of establishing radio stations as auxiliaries to its telegraph and telephone lines.

One of the possibilities of this system is that engineers of trains can keep in direct touch with the dispatcher's office at all times during the trip. This will make possible a strict control of each train, thus minimizing the danger of accidents. This is an immediate possibility. Another possibility of the near future involves telephonic communication between business offices in cities and passengers aboard express trains.

# Back-Stage with "Radio Mike"

## How Broadcasters Send Realistic Drama over the Air

By W. T. Meenam

F 1 OU ever have listened to drama over the radio, have you wondered how effects of rain thunder wind, and similar noises are created before the microphone in the studio of the broadcasting station, to add vivid reality to the spoken play?

Successful transmission of a dramatic production by radio is greatly dependent upon sound properties to take the place The torch produced the effect of rushing wind and flame. The paper, enabled close to the increphone, sounded to rushe audiences like the cracking of burning tree branches. The breaking of small matches produced the realistic effect of the breaking of buge tree trunks.

In the production of another play, entitled "The Fortune Bunter," a rainstorm was necessary. Instead of waiting to broadcast on a stormy night when the real rain might be available, a thoroughly Pierre feigns death and falls in the dead leaves carpeting the forest. Then, so Durkes approaches, Pierre grapples with his enemy and kills him in a desperate hand-to-hand conflict. Pierre rides away on his horse.

In "staging" this scene, the shot fired by the villain, of course, is produced by a revolver. In the hand-to-hand fight the actors grapple knee-deep in onion-skip paper, and a microphone on the floor picks up the sound of the rustling paper



Observings I above brown in full regular manifesting and a non-war domin order for the properties of the first properties of the Standard Will Behindertoly N.Y. Thus or bookly were the first time that a war dance had been broodenat by waveless.

of stage action. Thus atmosphere is created and the imagination of the harer is at malated. To obtain this atmosphere many devices are improvised to suit the needs of a particular production. Considerable experimenting often is necessary to produce the sound desired.

It is easy to imagine how such common noises as the stamming of a door, the breaking of glass, the barking of a dog, or the ringing of bells are reproduced for radio audiences. In fact, such sounds have offered few obstacles to broadcasting producers. But when the manuscript of a radio play calls for such a spectacle as a forest fire, with crashing trees and roaring flames, what then? If the play is to be broadcast successfully, a vivid portrayal of raging conflagration becomes vital.

Just such a problem confronted the producers of a drama called "The Storm," which was broadcast with striking effect by Station WGY, Schenectady, N. Y. At the climax of the play a great forest fire was to cut off the hero, heroine, and rival from the rest of the world. The way in which the effect of this dramauc setting was sent "over the sir" was remarkably ingenious, especially since it was produced before the microphone with such simple instruments as a gasoline blowtorch, matches, and paper

Edward R Smith director of the WOY players, with the bell board and door used to produce sound atmosphere for the radio drame. The bell hourd contains door telephone, clock chime, alarm, tap bells and busier all connected with dry batteries and operated by the pressure of a button. The entrance and exit of characters are indicated by the second of the opening and closing door.

realistic effect was created simply by rolling dried pear through a paper tube directly in front of the microphone. The paper tube magnified the sound so that to distant radio listeners the effect was a first class rainstorm.

The staging of a fight scene before the microphone in such a way that the thrills will not be lost to the invisible audience is surprisingly ingenious. In such a scene from "Pierre of the Plans," which was broadcast not long ago, "Jap" Darking, the villain, fires at Pierre from ambush.

President ing he half white it Please of he In to A device it in a he should be rended for Pietre. Then the set we put top og Pietre and the enrolly grunde kine dere til som vikin paper rust ing the sea to it will realisate bouggin.

to a set they are scattered in the strapples of the At the end of the space a books as a relies nway as prospect to the region of the stakes or a world are fare

In order to have within easy reach frequently used bells, the "property man" of the WGY "radio theater" constructed a bell board containing an the necessary combinations such as doorbell, telephone bell, call bell, and buzzer, mounted on one board and connected with batteries. Burglar, ambulance, and fire alarms, a clock chime and tan bell also were included.

chime and tap bell also were included.

The entrance or exit of a character in a radio drama must be conveyed to the invisible audience by the audible closing of a door. This is one of the peculiar conventions of dramatic broadcasting. Generally, in dramatic troduction, a softly closing door is desir-

production, a softly closing door is desirable and conventional, but over the air the actual sound of the closing of the door is the only means of denoting the exit or entrance of a character. Therefore a small portable door of thin oak in a specially mounted frame with peculiar resonance was constructed so that the noise of closing it could be transmitted easily and so that the turning of the key in the lock also would be noticeably audible to the thousands of unseen "play-goers."

# How to Build a Super-Heterodyne

# Part I-The First Detector and Two-Stage Amplifier Units

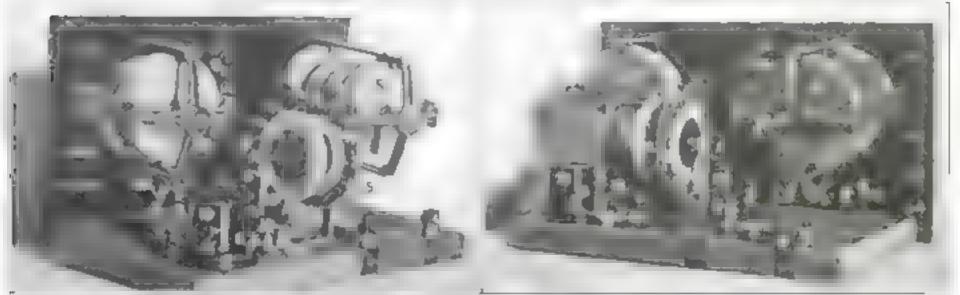


Fig. 1. Two views of the coefficies and first detector units, showing layout of parts numbered and bettered to correspond with Fig. 3

By Joseph Calcaterra Radio Editor of Popular Science Monthly

HE super-heterodyne is recognized generally as being the most sonsitive and the most selective of all radio receiving sets. For that reason

the dream of almost every real radio faris to own one sooner or later

Because of its size and intricacy, however, many persons who like to build their own sets have begitated to build the king of radio instruments. Yet such a feat is entirely possible.

In fact, it is in response to many requests from Popular Science MONTHLY readers that I am describing, In this and next month's issues, just how to build the super-heterodyne,

For the sales of simplicity, as well as utility, the set is constructed in three units. It can be used not only as an eight-tube super-heterodyne receiver, but, with slight changes in connections, can be adapted for use as a simple three-tube non-regenerative bones comb-coil receiver for reception of local stations with an outside aerual

This month I shall describe the con-





Front works of controls 4 feets at

struction of the conflictor and first detector up t, and the two-stege audio-frequency ampliner unit

Next morth I shall tel how to build the intermed. ate amphiler and second detector unit. In addition, I shall give complete instructions for connecting the units, and tell how to

operate the complete receiver.

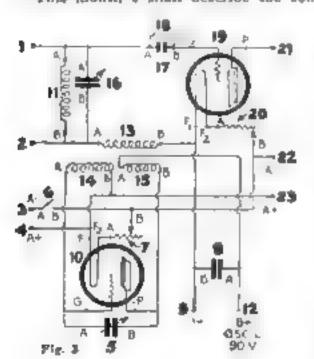
The symbols on the wiring diagrams of the detector and amplifier units. shown at the bottom of the page, have been numbered and lettered to correspond with the various parts on the photographs.

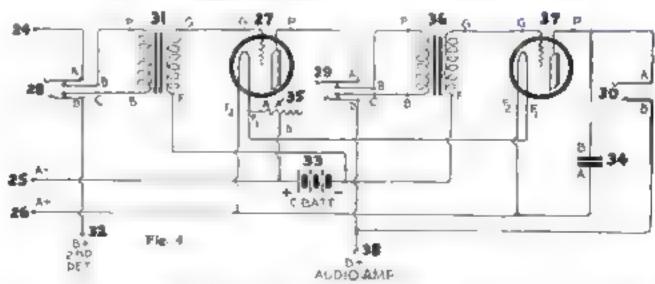
UMBERS 1 and 2 of the detector unit (Figs. 1 and 8) are the aerial and ground terminals respectively, when such are to be used. When a loop aerial is used, one end of the loop should be connected with terminal 1; the other end with terminal 2.

> Number 3 is the negative A-battery terminal, and No. 4 the positive Abattery terminal.

Number 5 is the variable condenser. used to tune the oscillator circuit to the desired frequency. This condenser should have a capacity of about .001 microfared and should be provided with a Vernier

Centinued on page 133)





At the left is the complete wiring diagram for the cuciliator and first detector unit shown in Fig. 1. The diagram above to for the two-stage audio-

frequency amplifier unit shows in Fig. 2. In each rase the symbols correspond to the numbered and lettered parts in the photographs also in above

# Radio Hints for Everybody

LTHOUGH you cannot eliminate static, you can, without much trouble, cut down the amount of static that crackles in the head phones or loudspeaker of your receiving set.

The surest way to do so is to use an indoor aerial -either a loop, or a single wire stretched in the attic, along a hallway or around a picture molding. With an nerial of this sort you can pick up local programs just as satisfactorily as with an outdoor serial, and with virtually no static Interference. You can get distance, too.

If inconvenient to use an indoor aerial, you can minimize the amount of static your set picks up by lowering your outdoor merial, setting it up, say, withir from 12 to 20 feet of the ground, And

part of the house's steam-heating system. Now, the "ground" is almost as im-

portant an aid to good reception as the aerial, and for this reason you should spare neither pains nor trouble in supplying it.

A Bostus radio anthusiast has perfected a set tube super-heterodyne set so sensitive that he uses it in his automobile so shown above, with-

out entrans or ground using. He says he has braced 25 stations from his our in one location and is always assured of entertainment

for various stations, for example, probably will not bring in those stations. The sensitiveness and selectivity of your receiver also may appear to be impaired. There is no way to remedy these conditions

except through experument.

Rechart Your dtal settings. Raise or lower, lengther or shorten your nerial. Be certain that you have a good ground connection. Don't, however, attempt any drastic siterstion of the set itself, for you may thereby store up trouble for yourself after your return home.

S OMETIMES the source of radio troubles la elusive because it is in such an obvious place, you never think of looking for it there. A scratching noise, for example, easily may



This compact bettery charger plugged into an electric-light socher, is designed to recharge a radio etorage battery oversight. An aluminum cover protects the apparatus, which is said to deliver or much current on 7 % annperca, constituing only 75 watth

even if you cannot, for some reason, try any of these things, you can keep static down by tuning in the local stations only

MOST people, when they buy radio sets, put up the best serials they can. Few, though, bother much about their ground connection. The nearest and handiest path to the ground usually suffices, whether it be a water pipe, a gas pipe, or

If possible, it should be a special from pape, or plate, buried in the ground a few feet from the wall of the house, and it should be an close to your receiver an you can get it. In other words, the lower floor of a house is the best location for a radio set, and the ground connection should be made direct, not through a complexity of water paper

IF YOU have a portable set, or if you remove your stationary set to camp or hotel during your vacation, remember that various conditions affecting radio reception may be decidedly different in the new location. Hence, you must not expect your receiver to function the name as when you are at home.

The dial settings that you have charted



couplers is this ingenious combination using a spider-web primary apider-web accordary and a separate three-turn coupling coll. All trindings are so arranged that the electrostatic mupling is practically "surp"

be caused by loose phone connections

More than one fan, after spending hours inspecting receiver, serial, and ground in a search for the possible causes of the scrutch, but discovered the trouble in a loose connection in his phones.

When the receiver "scratches." Inok first to the phones. Connect the phones, turn on the tubes, and shake the phone cord. If the trouble is there, you soon will know



You can talk through your loudspeaker simply by connecting the head get across the primary of the transformer of the first stage amplifier and speaking into one of the phones, the B battery being connected as usual

# Riding the Storm to Make the Air Roads Safe

By C. LeRoy Meisinger

Meteorologist, United States Weather Bureau

Doctor Meitinger as he appeared just before he stule to his dreth in the storm

HE meteorologist's aboratory is the atmosphere (tself, Unlike workers in many other tields of science, it is not easy for the meteorologist personally to work in more than a small portion of his Him efforts laboratory usual y are confined to that portion of the atmosphere that lies next to the ground

The United States Weather Bureau, however, in collaboration with the Army Air Service, recently has undertaken a project that involves the actual making of flights by one of ita representatives. A series of flights in spherical free balloons now is being made at the Air Service's lighterthan-air station at Scott Field, Ill

While the Weather Buresu does not expect to make sweeping "discoveries" in undertaking these flights, it does hope to

gather data concerning air movements at free-sir levels that can be obserzed in no

Where does a given small mass of sir travel in the course of several days? As we stand out of doors and feel the air blowing past us, what do we know of the path over the earth's surface that a certain particle of air is following?

Unless the air is considerably stirred up by local temperature inequalities, at a given level it will move approximately horizontally. Close to the surface, topographic tregularities also play an importent part in introducing vertical motions into the air; but at higher levels thus is not so conspicuous.

Therefore, if we may send a manned free balloon to some stated level, cause it to maintain its elevation as constantly as possible, and have the observer note carefully at all times the course of the balloon. the resulting path will be a close approxmation to the movement of air at that level. This is precisely what is being attempted at Scott Field.

The work is dependent for its success upon the knowledge of the track of the balloon. In clear weather, this means only close attention to maps as the balloon proceeds. But when the earth's surface is obscured by clouds, there are two means of checking the path: One is to drop weighted postcards that may be found and returned by the finder with a notation as to the time and place of finding. The The vertical dominution or increase of dustinesa in of considerable importance as a basis for studies in visibility, which is so important in aerial navigation

Equally important to visibility is sky brightness. Equipment is carried also

for the measurement of thus.

A radio receiving out is carried in the balloon, and the forecaster at Washington is able to communicate to the personnel of the balloon bulletine concerning the intest charges in weather conditions in the region in which

they are flying. Those bulletina have been very valuable

THE first flight of the series was made by the author with Lieut. L. A. Lawson on April 1 and 2. 1924, and subsequent flights have been made with Lieut James T. Neely, both excellent pilots of the A.r. Service. At the time of writing six fights have been made.

The ballonning is being carried on under weather conditions that are not always the most favorable from the standpoint of comfort and safety; but, thus far, the flights have been most successful and of the greatest meteorological interest. It is work in the meteorologist a luboratory that brings to the workers the thrill of adventure.

A Martyr in the Cause of Science

BEHIND the recent brief newspaper accounts of the tragic death of Dr C LeRoy Messenger, expert meteorologist of the United States Weather Bureau, her as dramatic a tale of bravery as ever came from a held of battle-another heroic chapter in the ceaseiess adventure of science into the strongholds of the unknown Doctor Messanger and his poot, Lieut-James T Neely, died in action near Bement, ill, when lightning destroyed the free balloon in which they had deliberately got out to ride the storm.

Doctor Meanager proposed to make the air safer for availson by studying the habits of storms so as to forecast them unlail-It was his idea that this could be done best by taking part in a storm, allowing bienself to be buffeted about in its relentions fury while he charted its movements and air currents

The fatal flight was the minth of a series of hazardous expedivions from Scott Field. III On the first voyage Doctor Meisinger dislited to Waterboro. S. C. where a landing was effected to prevent being swept out over the Atlantic Ocean. The second voyage was ended to keep from being blown over Lake Erie, and on the fourth flight death was narrowly averted, when the balloon, after bovering over storm-swept waters of Lake Michigan five hours, was blown back into Wisconsin

At the beginning of the investigations the Editor asked Ductor Messager to describe his work for the readers of Popu-LAR SCIENCE MONTHLY. The article on this page was written by Doctor Meisunger while his balloon was being inflated for the seventh flight. It breathes the modest seal with which a true hero faced unknown dangers in the cause of science. Throughout he hides his own identity behind that of the service for which he gave his life

> other is to determine the balloon's posttion by astronomical observation according to standard methods of navigation. This latter method is used only when the sky is clear overhead.

> THE balloons being used are of the apherical type employed for military training and balloon racing. The capacity is 35,000 cubic feet and hydrogen is used as the buoyant gas.

> The total lift is about a ton, approximately half of which is carried as expendable ballast. Under favorable weather conditions, such a balloon might be able to remain in the air from 36 to 40 hours. but usually this is not possible; and, when rain fails on it long, the added weight necessitates so rapid an expenditure of ballast that the flight often is terminated within from eight to 10 hours, sometimes

> Besides the fundamental work outlined above, data are being gathered in connection with other investigations. For instance, dust samples obtained at various elevations enable one to know the number of dust particles in a given volume of air

Contrictor U.S. Air Service.



Doctor Messinger's belloon taking off from Scott Field for its pinth and last voyage

# New Scientific Aids to Industry



Encurance of automobile agoings under vibration is tested in the machine above. Power from a drive shaft is transmitted to the apongs through a walking beam that flexes there in an exaggeration of road conditions

Checking Swedish-type gage blocks with a machine that detects inaccuracies up to one millionth of an inch. The blocks are shown in the tray in the foresround

# Where Is the Automobile Going?

# An Expert's Forecast of Improvements in the Next 25 Years

By Leslie V. Spencer, M.E.

What sort of motor vehicles will the drivers of the future operate?

At the rate of development maintained during the last 25 years, the motorist of 1950 will laugh heartily at our finest exactine creations of today, just as we cast an amused eye upon the horseless carriages of 1900, with their funny dashboards. their chargey engines underneath. their short wheel base. For undoubtedly the forces that have developed the motor-car to ita present degree of perfection will continue their influence.

The quality and price of fuel, for example, will play an important part, for gasoline transportation units always must take the fuel problem into consideration. Then, the demand for power along with

small bulk and low price must be reckoned with. Comfort, dependability, utility—these also are controlling factors.

Each year sees a greater tendency toward making cars equier to drive and simpler to handle. Beginning with the self-starter some years ago, development along lines of simpler operation has been marked, until today cars are very easy to handle, even by the frailest woman driver. Steering geam have been refined in every particular, gearsets have been studied closely with the idea of bringing the shifting down to the least arduous degree possible. Pedal actions and accelcrator mechanisms have been arranged so that brute strength is not essential to efficient handling. All these factors have tended to bring motor-car operation within reach of an over-increasing number of persons.

YET there is still much to be done along these lines; for, after all, with most cars, it is still necessary to shift geam around to change from one speed to another. Undoubtedly the day is not far off when there will be none of the manual gear lever manipulation almost universal in gasoline cars today. Some form of automatic or semi-automatic change of speed relation is in the offing. It will not be a tacked-on mechanism to go through the motions required at present, but it will be an integral part of whatever type of gearing is used.

Looking a little further into the future, undoubtedly we shall laugh whenever we inspect cars with any sort of intermediate system of gears at all. The gasoline engine of the years to come will run so smoothly



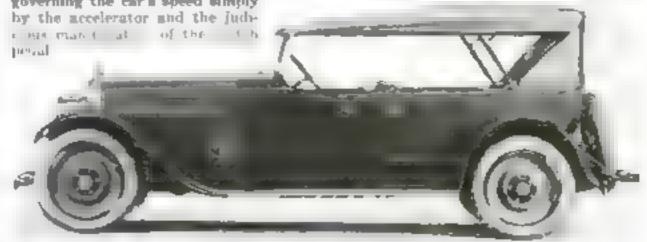
America's oldest sutomobile as it appeared in 1893 drives by Elwood Mayure its haider. Comparison of this little changing mechani

with the goverful, amouth-running car of 1924 shown below illustrates strikingly the emeding development of the automobile

and have such a nearly continuous flow of power that such a thing as drive through gears will be unnecessary.

Steam cars today do not need gearsets because the steam engine develops a steady power flow at any speed, whereas the power of a gasoline engine is intermittent. An gasoline engines have developed, however, they have approached nearer and nearer to the constant torque of the steam engine, and it is logical to expect this development to continue.

This will mean an entirely new satisfaction in driving. It will mean that you will simply start your engine, move a connecting lever while the clutch pedal is depressed, let in the clutch and proceed, governing the car's speed simply



The touring-our of today, with its tremendous power its graceful lines, and east of operation, may acces as crude and canons an oddity to

the motorist of 1950 in the horseless corriage of 25 years ago with its chaggy cupue and odd-looking dashboards, appears to us

many racing cars are built even now Already we have hints of changes in gearecta. One promment make of motor car is out with a gearnet that effects changes of speed between driving and driven shafts without meshing or demeshing any of the gears. This means less shifting trouble. runce one of the chief difficulties in shifting gears with-

out grinding in that

teeth of one gear actually must slide

with those of an-

engagement

Into

other.

There will be no shifting of gears back and forth, for there will be no gears to

shift. The drive will be direct from the

engine to the rear axle, just as a great

IN THE new year mechanism referred to, an ingentous shifting of keys is effected, the shaft thus picking up the desired year, which is never out of engagement with its mating year. The motions of granshift-

ing are gone through with just as with any other gearset, but the resulting movement of the parts is not the same. This interesting development is, without doubt, the forerunner of a new order of things in the transfer of the power from engine to rear wheels.

The entry of non-transmission vehicles into the field may be along with multicylinder engines such as we have not yet seen. One way of bringing about greater motor flexibility is to increase the number of cylinders. Although so far we have not gons beyond 12 cylinders in commercial care, it is not at all improbable that the gasoline engine of 1950 may have 24 or 48 little cylinders so arranged that the power impulses come with a frequency that will

he the next thing to continuous flow In that future day when there are no gearacts at all, cars naturally will be much lighter and simpler. Simplification means increased efficiency and dependability. The simpler the mechanism, the cheaper It is to manufacture, and the less the publie has to pay for it.

ALSO, when you reduce the number of parts, with consequent reduction in weight, you make a car cheaper to run. Loss weight means less power required to operate the machine, and hence less fuel cost. Is it, therefore, too much to my that we are almost on the threshold of the era of cheaper car operation as well as theaper care? Even if nothing is done have to cut out gear mechanism.

is assured.

Another factor that has its influence or reduction weight in the VENT LATTRE TO CLOSE OR UPEN constant prog-UNBREAKABLE GLASS FOR ALL WINDOWS ; DEARSH FT MADE UNNECESSARY BY 48-CYLINDER MOTOR LICENSE PLATE LIT UP

development of power plants that will run on such cheap fuela.

One of two things soon must happen if internal-combustion engines are to keep other types from crowding them out as the means of motor-car propulsion. Either present-day gasoline must come down radically in price, which seems highly improbable, or cheaper oils must be brought into use. As the number of cars increases, competition and public insistence will force engineers and inventors to develop ways and means for cheaper car operation.

Think what it would mean to the automobile public if every gailon of oil brought from the ground could be used in nearly its crude state in the operation of cars! a collecting device in proportion to the size of the vehicle. Then from this collecting arrangement the power will enter an electric motor to drive the car.

OOKING still further into the future. one well can imagine the day of the combined sirplane and road vehicle. Obviously, for short runs much a machine would be operated on its wheels, but once out of the city, or other congested area, it would stretch its wings and take to the air for long-distance hops. All one has to do to realize that such development is possible is to think back a hundred years. Do you suppose the wiseheads of 1824 dared risk their necks by predicting any one of

N DSPEARE RADIO SET WHEELS IN REAR DISAPPEARING STEP RUBBER OR AIR CUSHION AROUND CAR TO INSURE AGAINST DAMAGE PILTER JACKS ATTACHED TO PRAME AND OPERATED FRUM DRIVER'S SEAT SPLF STABILIZING FITON? Out artist's conception of the meter cut of 1950 hazed in Mr. Spencer a interesting WHEEL forecasts of three-wheeled it we between the wire made and it you wanbining economy comfort, and case of operation with a light, amouth-firthing engine S HALARITE DALLOON TIPLES of many cylinders, required no general file. Inspectant approvements are addicated

rees in metallurgy. Metals used today in ear construction are far in advance of what they were a few years ago. The Ford car, for example, would not be posalble at the price nor the weight if the present variatium steel alloys were not used most extensively. Alloys with aluminum, many of which have been perfected within the last few years, mean lightness with real strength, a most desirable combination.

We are cartainly nowhere near the ultimate in the development of combinetion metals, for the metallurgical laboratories of every big concern employing metals constantly are trying to come nearer to the ideal type of metal alloy for any given purpose. Perhaps in no industry is this activity more pronounced than in the field of car huilding.

The cost of gasoline is going to force the development of engines which will officiently use heavier oils that can be purchased for less money. Fuel oils that cost from five to seven cents a gallon are not adaptable now for motor-car use, but the days ahead will undoubtedly force the

Perhaps going all the way back to the oilwell is too big a step, but at least the type of oil now used by ships and for similar purposes ought to come eventually into motor-car use -a step forward that means almost unbelievable advance.

BUT when the day comes that we have direct-drive cars propelled by heavyoil engines, then we shall have gone as far as we can along the internal-combustionengine path. With the rapid strides electricity is taking, scientists and engineers predict a day when we shall have wireless. power transmission (or automobiles. The air will be filled with tremendous electrical energy from power stations, perhaps municipally operated. Each user of such power will have some sort of collector device, and he will be licensed and charged so much a month, say, depending upon what amount of electric energy his intake meter indicates he has drawn from the

The big factory will have its giant collector of power; each automobile will have, instead of an engine as we know it,

the mechanical marvels we think commonplace today?

But coming back to the near future, I think we can safely may that the open car, as we know it today, will be discarded. Every car built probably will have some form of convertible body, making it a simple matter to open it or close it, depending upon the weather. Disappearing windows, doors, and side panels to convert the body already are on the way.

The demand for cheap, quick transportation probably is going to mean the building of vehicles that are a cross between the motorcycle and the automobile perhaps little three-wheelers with light, smooth-running engines. Such cars will be most economical to buy and to run, and very easy to manipulate in traffic. They will be little one-centers-or two-seaters at the most-perhaps with inclosed bodies to make them independent of weather. They are a needed utility, and they are undoubtedly right ahead.

Next month---How to eliminate ourbon and save trouble, fuel, and repair bills in running your cat.

# New Inventions for Your Car



# Keeping Your Car in Good Order

# Money-Saving Ideas

TALLING of motor horns is one of the annoying troubles of autoists and it always occurs, of course, in the thickest traffic. Frequently it is due to the fact that the brushes do not make very good contact—a difficulty that can be climnated very easily by the method shown in Fig. 1.

The new brush springs are made from cut-off safety-pins. Leads to the field colls of the horn motor are connected with the loops of the pins by short screws and nuts. The brush holders are slotted with a hacksaw to receive the new springs and the ends of the cut-off pins are bent over for shout 1/16 in. of their

Since the safety-pins have more spring than the usual small springs that come

with such a born. the brush pressure is much greater and a good contact is ussured.

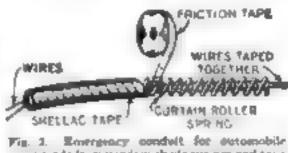
VARIOUS kinds of short-circuit troubles are experienced in automobiles because the insulation of the wiring been Worn through by chafing against metal edges. Much of this went can tie overcome by running the wires through strong, homemade condulto, an in

Procure an old curtain - roller apring and utretch it to malt the length of wires. Wrap the

F.g. 2.

AS EVERY car-owner knows, the oil in the crankcase of an automobile should be changed about every thousand miles or so if long engine life is to be expected. However, it is not always easy to remember just when you did change the oil last unless you reinforce your memory with some sort of record The simple counter shown in Fig. 4





wires made from window shade surings and tape



Piu. I

Safety-pto

repairs born mucor

Fig. J. Orwest cups haid repetr compounds

wires with friction-tape. Run them through the spring, then wrap the spring closely with friction-tups, making laps of not more than 14 in, being sure that each lap is well stuck to the one before When the apring is fully wound, give the whole a cost of shellac.

THE advantages of large greate cups as containers for valve grinding and soldering compounds will be apparent to the mechanic. Such containers may be stowed in the toolkit, without the usual annoyance of the materials' escaping, as so often happens when they are kept in their original tina.

Select greate cups of slightly different size, or one cup of breas and another of steel, for the different compounds, so that they can be distinguished readily. Better still, stencil the top to identify the contents.

In the stem of each of the containers, tap a small thread for the insertion of a knurled thumbscrew, as is shown in Fig. 3. It is necessary only to screw down the cap of the container to release the compound

a quick, convenient, and economical Containers of thu kind are method. especially useful to the auto-camper.



Fig. 4. Offing revised for garage made from phechers, leather washers and calds and ende



Fig. 4. How leather straps and rubber pada are used to prevent engine boods from ruttling

serves the purpose admirably and costs nothing to make, so it is built out of five old wooden checkers, a few leather washers, and a place of heavy tin or sheet bram-The numbers on the checkers are cut from an old calendar and fastened on with glue. A long screw with a butterfly-nut. serves both as an axle and as a clamping

Fasten the counter to the wall of your garage and when the oil in the crankcase is changed, set the recorder to correspond with the speedometer reading. Then you will know at any time just how far your car has gone since new oil was put in.

# for Auto Owners

THE valve-seat reamer shown in Fig. 5 is made so that it can be used in different engines. The feature is the stem or pilot, which is interchangeable. About three stems are necessary with diameters 5/16 (n., 3% in., and 7/16 in, respectively, The handle and stems are made of muchine steel

> and the cutter is tool steel, hardened. A tool like this is less expensive than three or more reamers and will take care of the average job that romes into the autotypair shop.

> ONE detail of the car that is difficult to silence, especially on trucks, is the hood. When one considers the ordinary method of hooking three down, it is evident that means of compensating for the

> > wear are not pro-

vided.

When the original fabric strips inserted in the ledges where the bood is seated have given way, they may be replaced with leather book straps, which are lared into the salts (Fig. 6) after the buckles have been removed

> Where the hood sests on the car frame ledges, a side movement frequently will make a disagreeable rattle. A method to prevent this man is shown in Fig. 6. Rubber pads made from abort lengths of rubber tube are carried around the ledges.

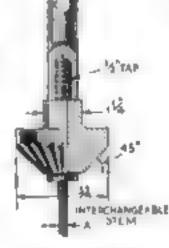


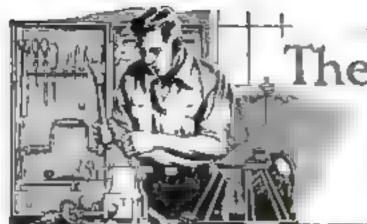
Fig. 3. Meternet with saterchangeable pikkti

WHEN religing four-wheel brakes, it is desirable to renew the Unings of all the brakes at the same time, using the same grade of material, so that the identical thickness of Uning will permit of more uniformity in the adjustment.

The front wheels should be pointed directly shead while adjustments are being made, for the reason that most of the brakes are constructed to release the outside wheel when turned either to right or left. Adjust all the bands so that they are uniformly tight, testing by slightly releas

ing the pressure on the pedal.

It is contended by some designers that the rear brakes of the car should grip more solidly than the front in order to lessen interference with steering. However, the construction that frees one front wheel when turning right or left normally meets all needs in steering with the brakes locked. Any adjustment to make the front brakes less effective than the rear would be difficult for the average owner or garageman to make and possibly stight result in the front brakes' not coming into



# Home Workshop

Arthur Wakeling, Editor

## Your Tools and Their Care

By Albert S. Peacock

Shop Superintendent, New York University; Consulting Expert on Tools, Popular Science Institute of Standards

"File? What do you mean? I am sharpening this plane iron."

"Oh! I thought you were trying to dig a groove into that atone you have there," said Old Prentise in a voice and with a smile that savored strongly of sarcasm

Old Prentim had charge of the shop where I learned to know my friends, the tools. Jim was one of us—the gang—and had the makings of a good mechanic, but there were too many rough edges. One of them was about to be knocked off by Old Prenties, and I sidled closer to hear what he had to say

"Now, laten," the old for continued. "Let's see if we can apply common sense to this proposition, as we ought to

apply it to everything we do. There are very few of us who can run our arms or our bodies back and forth in a perfectly atraight line—I mean so that we can move a plane Iron, a chisel, a knife, or any other tool straight back and forth across an oll-stone and keep the tool from rocking. I know you may have heard that that is the way, but let me tell you, 40 years at a game of this sort give a fellow a pretty fair notion of the best way to do a job, and the way you are doing it isn't my notion of the right way

"Instead of getting a straight bevel on the tool, you are likely to rock it a bit and give it a convex surface. Of course, that doesn't give the suge the proper shape

Ten, too, it stands to reason that you are going to day a reason to day the stone to a reason the

been using it for seven years and have not had it refaced. Still, there's not a single, solitary groove in it. Why? Because I move my tools in circles over the surface, covering the entire area. It isn't so hard then to keep the bevel straight, and by moving in small circles I also avoid gouging the stone.



Correct method of drawing a socket chisel (at left) as compared with mouse of a puring chied (at right)

"Another thing -I notice that you seem to exert as much or even greater pressure on the backward stroke as on the forward stroke. What's that going to do for you? It will turn of a heavy feather edge, and it'll be some little job for you to remove the feather edge and put a razor edge on the tool

Bear down on the forward stroke and you will cut against the edge, keeping the feather at a minimum and yet cutting aufficiently to give you a keen, sharp edge. Of course, you'll turn off a slight feather, but that can be removed by giving it a stroke on the back, pushing the blade away from you and holding it perfectly flat on the stone. Then give one stroke on the bevel, another on the back, and so on until the feather has worn off

the stone At this point Old Prentum saw me over you we seen the by one of the lathes with my head tilted one I bave. I've at such an angle that he knew I was

"listening in." He took that as an invitation to is unch into his pet subject—"the tise and abuse of tools." It was not a very busy morning, so be invited me over to hear what he had to say.

"Now, you young fe, lows know as well as I do how difficult it is to do a job when you have no tools. But you might just

> about as well not have any tools as have poorly kept ones.

> "To get back to something I was just telling Jim—what use is an oilstone if it isn't flat? And yet if Jim had continued at the rate be was going, he would soon have his looking dished, like the track in an autodrome!

"You fellows have been with me a year and yet one of you is guilty of putting that very oilstone back on the shelf with all the oil and dirt still on it. I want you always to put back your tools clean and in good condition. It won't do a bit of harm to clean your oilstone occasionally with kerosene. When a chisel has been nicked, don't put

it away as it is, for the chances are that the next time you want that very size chirel, you won't have time to grind it up. If you put in a nick, take it out right away. Clean off the tool and put on a thin coat of oil occasionally to keep it from rusting. Don't throw your edged tools into a chest or drawer full of other tools

I might say something here on the subject of grinding on a carborundum, or other artificial wheel. You know the speed at which one of these turn, and you know the heat that can be readily devel-

oped by them. Be very careful not to draw the temper. I was der if you know how little heat as required to



Two crimes against tools and a group of casualties. The new has lost several teeth, the bit has been best and the point rained by too much pressure, the try-aquare blade has been used as a pry, the plane was broken by being dropped, and the other tools were damaged by samilar above

## Lamp-Shades from Wooden Bowls

By Gladstone Califf Superintendent of Schools, Richtand, Is.

OW to make an attractive shade is a problem to be solved whenever a table lamp is to be constructed in the home workshop. Shades generally are made by covering a wire frame with

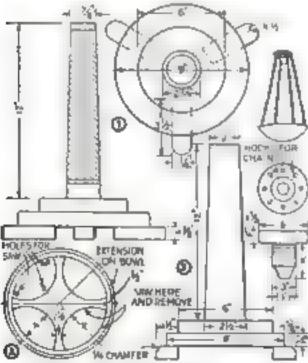
or imitation parchment. Far more unique and even less expensive are shades made as Illustrated from wooden chopping-bowls. Such a shade may be ornamented in various

Of the three lamps detailed below, No. 1 is made in the following way Lay out two circles for the

circular members of the base and cut them out with a circle or coping saw keeping a short distance beyond the line Smooth the edges with a rasp and sand-

The upright is part of an old table legbut it can be made by hand by the method described in my article, "Making n "Turned' Spiral Pedestal," in the April IBBUR Of POPULAR SCIENCE MONTHER The small base supports are made according to the dimensions indicated. Before nmembling the parts with screws and glue, born a \$5-in, hole in the uprights for the wiring.

The shade is a wooden chopping-bowl 15 ln. in diameter. A steel cabshet acraper is used to remove the rough places, both inside and outside, supplemented with a safety-razor blade. Fine eandpaper completes the work of smoothing. The putside is stained and finished like the pedestal. and then the inside is enameled white to



Details of two long-stands, a choppingbowl shade, and so inderect lighting fixture

reflect the light. A fringe or beading in attached around the inside of the bowl with small tacks.

Lamp No. 2 is even simpler to construct. Make the two square pieces for the base and cut the base supports, giving

the latter a }{-in. chamfer on two sides. The apright may be one piece or two pleces glued together. First plane the upright so that it is 214 in, wide the full length of the piece. Find the center of one and, mark a line I in, on each side of the center and draw slanting lines from the opposite ends to these marks at the



Lump No. 1 to shown at left, No. 2 of right, and No. 3 in the center

top. Do this on the opposite mide and plane down to the slunting lines. Repeat the operation on the remaining sides in order to complete the taper. Drill a 3/in, hole through the upright for wiring

The upright for lamp No. 3 was made from a discarded pedestal. It would be a simple matter to turn a similar stand if a lathe is available, and, lacking this, it costs very little to have a turning made. The base is 10 in. in diameter, with a by in chamfer around the edge, and the four base supports are chamfered in the same way

The shades for lamps Nos. 2 and 3 are pierced chopping-bowls. First find the center of the bowl and draw two lines through it as indicated in the accompanying drawing. With a compass describe the four area shown. Then, to allow the insertion of a coping-saw blade, bore three be in holes in each of the four places to be cut out. Make the saw kerf or cut a slight distance from the line and smooth it with a rasp and sandpaper. The cut edges may be beveled, rounded, or molded to give the shade a lighter appearance, if the maker wishes to go to that trouble. Scrape and sand the bowl inside and outside, as in the case of lamp No. 1

THE shades shown are lined with a double thickness of old-rose silk This is done by cutting a paper pattern to fit half the maide of the shade and using this as a guide in cutting the side. The lining is held in place with thumb-tacks and a strip of tape made of the same silk is sewed over the tacks. The tacks may be cut a trifle short, as the wood is hard Parchment or oiled water-color paper may be used in place of the silk, if preferred.

The standard of each lamp is walnut. and the bowls, which are maple, have been stained to match with water stain. Lamp No. I was given two coats of walnut water stain, 2 coats of white shelled, each coat being well rubbed, and then finished with varrush, the last coats well rubbed with

> pumice-stone and oil The other two lamps were stained and finished by French pol-

Another use for a chopping-bowl is to form a shade for an indirect light, no shown at the right hand of the accompanying drawing. The bowl is finished in the same marner as that of lamp No. I and the

ceiling plate is constructed as shown and finished to match the bowl. The brain chains are fastened to hooks on the inside of the how, and hung from books in the cealing plate. The electric wires run through the reiling plate and down alongade one of the chains to the light, which as in the bottem of the bowl.

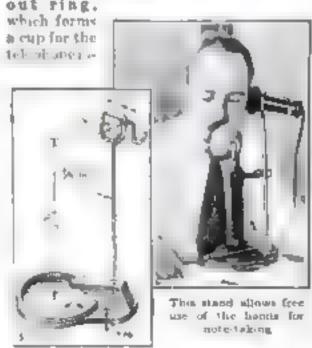
A good fidash for such a bowl is simply three costs of orange sheling, rubbed between coats, and several coats of thin wax

Hardware and electric fittings for the lampe can be purchased in any electric supply store. These lamp fittings have a bram rod that supports the shade; the upper part of this red projects through the shade, which is held in place by a brass nut. Each lamp has two pull-chain sockets. If desired, silk cord may be used to lengthen the chains

#### Stand Holds Telephone Receiver while in Use

TO ALLOW free use of both hands while telephoning is the purpose of the incompactous stand illustrated.

Glued to the wooden base is a sawedout ring. which forms a cup for the telephones a



A block shaped as shown holds the telephone in place without any screws, and this piece also supports a rod, preferably of M-in. aluminum wire, bent to hold the receiver .- J G.

## "Antique" Cabinet Cheaply Built

HAVE just finished the construction of an "antique" china closet from pieces of lumber taken from an old reed organ.

Old reed organs may be obtained

cheaply from music dealers, yet they contain beautiful lumber, untally solid walnut or solid oak. There are many fine turnings and moldings on them that cannot be had in any other way without considerable expense. The lumber is well seasoned, often more than 50 years old, and it has been used just enough to make it mutable for developing the "antique look" now so highly esteemed.

The two-tone effect at present in vogue can be duplicated by covering portions of the panels in the cupboard with panels of acrollwork taken from the old organ. The cupboard panel is finished first in one tone: then the scrollwork is placed over it. and finished in another tone. The

ecroliwork is fastened on by gluing it lightly on the back and nalting it in place with brade sunk with a nailset.

As the cupboard was put together, the old varnush was removed from each piece with cabinet scrapers, glass, steel wool, knives, and sandpaper. The wood was

By Rufus E. Deering

stained before varnishing, but it was not necessary to use a filler as the surface was quite smooth with the original filling.

BACK SHELF SA W DE MOLDING. DOOR FRAME 20"X25" SHELVES: REAR LEGS

Beautiful aged only from un obsolete reed pries furtueled most of the material for this entique looking thine closet. The ornemental top acrollwork and molding were token from the organ - the front legs were mode by hand as described in the July spins

The back of the cuphoard was made by placing rails with grooves at the top and bottom. The ends of the back boards rest in these grooves.

The frame for the door was adapted from a panel frame of the organ. The lower part of the door was paneled over so that the dishes on the lowest shelf of the cupboard would not be visible. The bulk of the dishes are stored here out of night, and the two top shelves left for the prettier duhes and glam.

The legs were made of straight pieces of stock 30 in. long and 11/4 in. square. The two front legs were made in a spire. shape by a method of band turning described on page 78 of the July issue of POPULAR SCIENCE MONTHLY, The two back legs were tapered alightly toward the bottom.

To fasten the legs, they were allowed to extend up in the corners of the cupboard and were screwed oncurely. The two back legs then were braced with three-cornered pieces to the back of the cuphoard

The ornamental top and moldings were adapted from the organ material as shown, but this feature could be varied in many ways, socording to the meterial on hand. The

moldings were all simple flat moldings 114 or 134 in. wide. The wood was given a shellac-wax finish

The whole cupboard, of course, might be built of new lumber, but it would be harder to give it the antique look that is so valuable in a piece of furniture like this.

## How to Keep Your Automobile Polished

By George A. Lucra Automotive Engineer

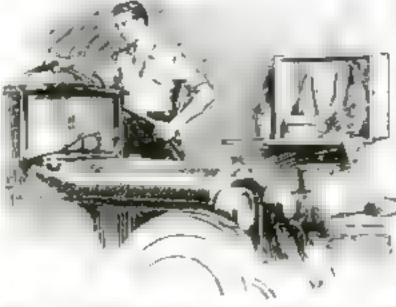
THEN the garage door swung open and Jackson's car rolled into the alley, the paint ghistened in the sunlight. Any one who did not know the car would have said it had just come from the paint shop. Those who knew Jackson and his car, however, were aware that the machine was three years old and never had been repainted.

The difference in the appearance of similar cars after a year or more of service is so pronounced that every owner must appreciate the need of proper care and treatment to maintain the original gloss and

luster. Jackson had given his cur the

requirite attention.

Normally, there are two natural elements ruinous to the paint: Exposure to the heat and bleaching of bright sunshine, and the solvent action of rain and snow One human element also enters into the rapid destruction of the painted surface—



the tendency of the owner to wipe of the vernish with any available rag, regardless of grit, grime, or grease.

To avoid these requires only a little care. Follow Jackson's example and do not park your car day and night in the open street, or clean it with any old cloth.

The paint is a film little more than .02

in, thick. The upper surface, which is a varnish or special lacquer, is a hard film and takes a high gloss. This film must be kept intact in order that the color paint underneath will be protected and retain its brilliancy.

The equipment to care for the paint and also the top and upholstery is as follows:

236-gal, wash pull Custile soup CILBREOLE

Cheme-cloth Spunge Whisk-brown

Probably most car owners have these materials on hand, but it is necessary to understand their proper use to obtain the most denirable results.

Rubbing the body should never be done before it has been dusted off with the woolen duster to remove avery particle of grit. Hosing mud off the body preferably should be done by flushing and not with the force of the bose. Another method

(Continued on page 102)

## Constructing a Six-Inch Jointer

By Frank N. Coakley

N DESIGNING machinery for the home workshop two points must be home in mind. One is that the machine should be as strong as its manufactured brother; the other is that easily obtainable stock should be used as far as possible, to avoid the rost of having patterns made for castings.

Both these requirements I have tried to observe in designing the 8-in, jointer for the home workshop shown in the accompanying drawings. The entire machine is made of oak or other hard wood and standard parts that may be purchased at hardware stores and from dealers in machinary. Even the scrap pile or junk yard may yield some necessary parts. These sources of supply I can eately leave

to the ingenious builder.

The side members of the jointer are made from oak plank 2½ in, thick and of the width and length shown in the side view. Pains should be taken to give the various pieces a good finish wherever they fit together, and the holes that are to be used for boits should be drilled smaller than the boits. That is to say, the boles for the 9/18-in, bolts are to be ½ in, in diameter so that the bolt can be driven through, making a tight fit. A heavy washer of good size is to be placed between the wood and the nut wherever they opine together to prevent the nut from digging into the wood.

THE countembalt for driving the cutter is fastened directly to the bottom members. The bearings are standard 11g-in, bore by 2% or 2% in, long, securely bolted to the bottom members. Each bearing is provided with a grease cup.

The size of pulleys and other dimensions not mentioned hereafter will be found in the drawing. Care is to be taken that all the bearings are in perfect almement, which is always most important.

The tables are made from steel plate perfectly level and smooth. To the bottom of these plates are riveted 214 by 214

by ¼ in, angles, the rivets being countersunk on the upper side of the plate and smoothed off carefully. To the sides of these angles the wooden wedges are fastened with eval head wood bolts, the nute being on the inside against the angles.

The bottom wedges are bolted securely to the stationary members. This allows



Most of the labor of head planning is eliminated by thing a bench jointer

wingnuts for clamping the table in position, two being used for each table. Between the two side members two separators are used for holding them in line and four 9/16-in, bolts serve for clamping.

For the adjustment of the end table at the entering and of the machine, reference should be made to detail A. The separator just mentioned is used as a support for the flat bar, which is tapped to receive the adjusting screw. A 2 by 2 in angle is riveted to the top plate and the hole for the adjusting screw is oblong or sval to allow the screw to move when the table is being raised or lowered. This adjusting screw is not shown for the delivery end, as it is seldom that this table is changed, but if it is thought advisable to put one on, the same material and method may be used.

The fence is made from \(\frac{1}{2}\)-in, steel plate 2 in, wide and 14 in, long. The ad-

justment is obtained by using two 2 by 2 by 34 in. angles as brackets, both being provided with holes at the bottom so that they serve as a binge. One angle is riveted to the fence and the other is clamped to the table with standard thumb-nuts. A slotted hole is provided to allow the fence to alide back and forth, as indicated in detail E. The three holes in the bettom angle will give settings for two angles—2214 degrees and 46 degrees. Others may be provided by drilling beles in the necessary locations.

The two bearings for the cutter head are standard bearings for a 1 4-a.n. shaft. It is advisable to use bearings with removable bearing caps, as it may be necessary

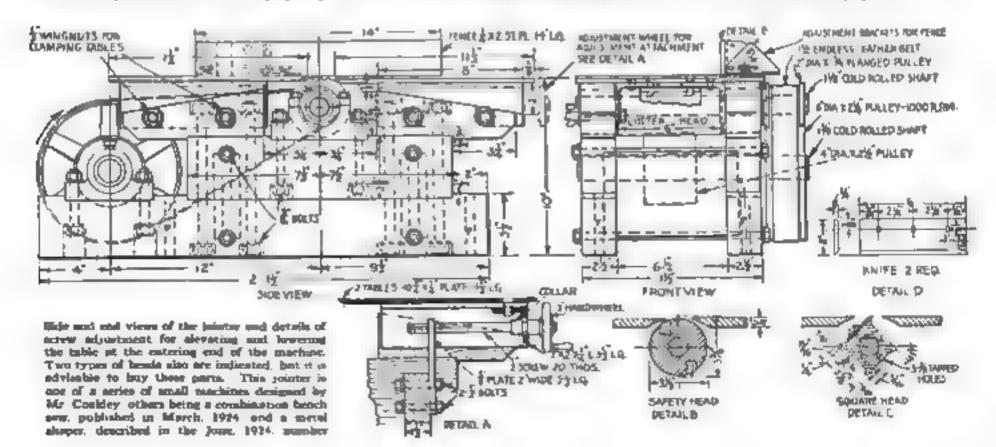
at turnes to remove the head

Two styles of heads may be used, one known as the safety head, shown at R and the older style of square head, at C. The builder will find either satisfactory and should select the one he is best equipped to make, no doubt that shown at C. It is to be remembered, however, that in many shops the old-fashioned square head has been replaced by the safety head, as in case of an accident the latter cannot do more than take of a small slice from one's fingers, whereas the square head has been responsible for many serious accidents.

IF ONE doesn't care to make the safety head, yet wishes to use one, it can be bought at a low price. This is, perhaps advisable, because it is necessary to have this part of the machine run true and be in perfect balance. The head either may be keyed or fastened to the shaft with set screws. If keyed, two short keys may be used—one driven from each end. They need not be larger than 3/16 in. square, but must be a good fit. If setscrews are used, four are needed, equally spaced and set slightly into the shaft.

The knives are another part of the machine I should advise one to purchase, not because they cannot be made by the amateur mechanic, but on account of the tempering and grinding. One can pur-

(Continued on page 112)



## FREE-25¢ Book on Wood Finishing



If you have a hobby for making cabinets, furniture, radio boxes, etc., —you will find our Book invaluable. For, naturally, you want to give your handswork a beautiful finish. Our Book gives complete instructions for finishing all wood—hard or soft, old or new. Tells how to make soft woods beautiful as hardwood. It is the work of experts—beautifully illustrated in color. Gives covering capacities—includes color charts, etc. Use coupon below.

## JOHNSON'S WOOD DYE

Johnson's Wood Dye is very easy to apply. It dries in four hours and will not rub off or smudge penetrates deeply, bringing out the beauty of the grain. Johnson's Wood Dye is made in 16 popular shades as follows:

No. 128 Light Mahogany
No. 129 Dark Mahogany
No. 120 Brown Mahogany
No. 120 Fumed Oak
No. 123 Dark Oak
No. 124 Light Oak
No. 126 Light Oak
No. 126 Light Oak
No. 126 Light Oak
No. 127 Mission Oak
No. 130 Weathered Oak
No. 130 Weathered Oak
No. 130 Weathered Oak
No. 130 Weathered Oak
No. 131 Walnut
No. 140 Early English

No. 124 Golden Oak No. 180 Gray No. 160 Brown Oak

All shades may be easily lightened, darkened or intermixed. Full directions on every label. Select the shade of Dye you want from the list above and order it from your dealer by name and number.

#### S. C. JOHNSON & SON, RACIKE, WIS.

"The Wood Finishing Authorities"

Johnson's Wood Dye is a dye in every sense of the word. It contains no finish whatsoever. Like most first class products it answers one purpose only—it dyes the wood—the finish must be applied over it—We recommend Johnson's Varnishes or Johnson's Polishing Wax.

Stores duplaying the Johnson Service Department Sign carry a complete stock of Johnson's Artistic Wood Finishes and will be glad to show you finished wood panels—and answer questions on how to finish wood the proper way and give you a copy of the Johnson Book.



## S. C. JOHNSON & SQN, Buil., P.S.M. S, RACINE, WIS. "The Wood Finishing Authorities"

(Consider Factory—Brankford)

set send set free your Instruction Book on H

Picese send me free your lastruction Book on Home Beautifying and Wood Function, I enclose 10c to cover postage and wrapping.

MY DEALER IS

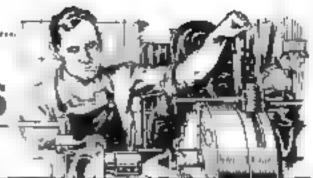
My Name

Address.

City and State

# Better Shop Methods

How Expert Mechanics Save Time and Labor



## Making the Most of Your Milling Machine

By Albert A. Dowd Consulting Engineer

"HERE'S a young fellow over there," said the foreman, "who gets my goat. Every time I give him a new job, he spends 10 or 15 minutes looking at it before he does a tap of work."

The superintendent amned, as he irquired, "How does he do his work after he does get started?"

"That's the funny part of it," the foremen continued; "he makes better time or most jobs than any of the other milling-machine hands, and for that reason I can't say very much to bim. But it



Albert A Dowd

THIS is the first of a series of noteworthy actic les written especially for POP-ULAR SCIENCE MONTHLY by Mr Dowd, who has a national reputation as an expert on mechine-shop practice. His next article in Machining Troubles."

when you have a single milling job given you by the foreman, it isn't usually the actual cutting of the metal that takes the time, but the finding of angle plates,

he was going to do it. He set it up quickly

and carried it through to completion

the actual cutting of the metal that takes the time, but the finding of angle plutes, parallels, clamps, and the like, and setting up the machine ready for the work. Even in high production milling processes, when fixtures are used for holding and locating the work, the setting-up time is an important factor

In any kind of a milling job you have two problems to consider. First, to locate and hold the work on the table, and sec-

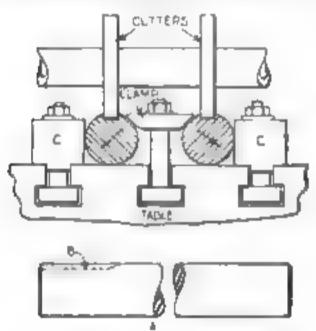


Fig. 2. For milling two boyways at once

certainly does stir me up to see him stand over there by the window and stare at a plees of work as if hypnotized, while his machine stands idle sometimes for half an hour."

"Well, I wouldn't worry about it, as long as he does his work properly," said the superintendent, as he walked briskly away to another department.

He made it a point, on his return in an

hour or so, to pass through the milling department again, and noticed that now the young man was busily engaged, and his muchine was tearing through a beavy steel forging at a rate that appeared likely to produce reguits. Out of curiosity, the superintendent looked up a few records in the cost department, and found that the man in question was making more money on piece work than any other operator in the milling department, although his rate was somewhat Why? Just because he thought out his job beforeband and knew just how

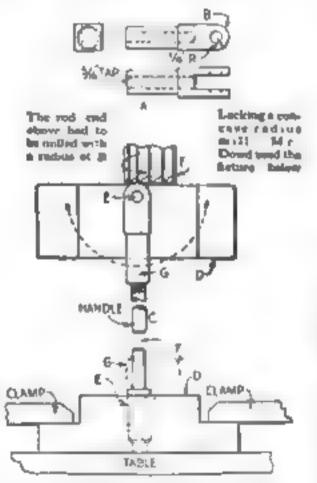


Fig. 1. Redius milling with an and mill

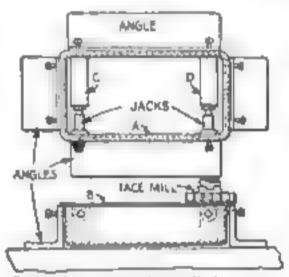


Fig. 3. Supporting this wall of a casting

ond, to machine it according to requirements. Every man who operates a mining machine knows that work must be held very rigidly in order to prevent "chatter" When work comes through a few pieces at a time and must be machined without fixtures, your foremen may offer a suggestion as to the best method of setting up, but it is up to you to do the work. If you do a little thinking before starting the job, you will find it a great advantage. You often get some job that appears simple at first glance, yet you may have trouble

with it because you have not been careful in the setting up —in other words, because you did not stop to think it out properly beforehand

I remember very well the first job I had when I started work in an automobile factory in Connecticut a few years ago. The foreman gave me a blueprint of the rod-end shown in Fig 1 at A and told me that there were 60 pieces on which the radius, B, was to be milled and that he wanted the entire job by three o'clock that afternoon.

The pieces had been machined and nothing more was (Communed on page 94)

#### Old Bill Says-

WHEN you have many jobs to do, the quickest and easiest way is to do only one at a time

The fellow who says, "That can't be done" generally wakes up when he sees somebody doing it.

If you want to change your luck, put a p" in front of it, and keep plugging.

The man who uses a monkey wrench to hammer a cold church doesn't belong in any machine-shop. I d rather have my shoulders to the wheel than have my buck to the wall.

Almost any one can do the easy work; it takes a good mechange on the hard jobs

Dun't forget to remove all burrs and sharp corners from your work with a file, so that the other fellow won't tear his hands.

# At Last

A PRACTICAL HAND BOOK for the MOTOR MACHINIST and AUTO REPAIR MAN

The Book you've been looking for

Here it is—the Starrett Book for Motor Machinists and Auto Repairmen; first and only book of its land ever published. Over 200 pages of data on the maintenance and repair of autos and trucks and when you look it over you'll say three loose quarters never brought more value.

This Handbook has been prepared by authorities in the automotive world. Written for the man in the shop. Profusely illustrated. Diagrams. Tables. Well printed, Bound in handsome red Athol-leather Handy size (4% x 7% i") for carrying in pocket. In every way Volume III of the Starrett Books is a fitting companion to Volumes I and II (The Starrett Book for Machinists' Apprentices and The Starrett Data Book for Machinists) of which nearly 100,000 copies have been bought. by skilled machinists as well as those learning the metal working trades.

If you work on a car this Starrett Book will pay for itself a hundred times over. Get it for 75c, at any hardware store selling Starrett Tools. If there is no dealer near you, send 75 cents and we will mail you a copy with charges prepaid. Whichever you do-ACT PROMPTLY. The first edition is lumited and these practical handbooks will go fast.

> Write for the new Starrett Catalog No. 23 "W" describing over 2200 fine Precision Tools for Machinists, Auto-Repairmen, Corporters and Mechanica.

> > THE L. S. STARRETT CO.

#### The Book that shows how to do it right!

Posted Table of Contents

LAYING OUT WORK
DEILING selecting speeds and leads, grinding
drill posts, transleptoring, etc.
TAPPING pregranding taps, removing brakes taps,
use and care of thes, etc.)
REAMERS AND REAMING

FILING
HACESAW CUTTING
GRINDING (whoch adaption, mounting, dynamical
GRINDING)

LATHE WORK (care, indication, adjusting, le-escand orstorn, setting tools, testing, turning, checking. HOW TO READ AND THE ADJUSTMENT OF

HICROMETERS
HICROMETERS
MILLING AND MILLING MACHINES
TEIREAD COTTING
FIES AND FITTING
GAGING CYLINDER BORES
FISTON GRINDING
FISTON GRINDING

PINTON GRINDING
PITTING PLITONS AND PINS.
CYLINGER HINNING
LAPPING VILINDERS
VALVE PITTING.
FITTING CRANKSHAFT AND CONTROD
BEARINGS
ADJ. TINL TAPPETS
SIGNE FATTING
DELARS NATING
THE ACETYLANE TORCH
MELDING MILLERING AND BRAZING
CHAIN DISCOUNTS (how to brus)
DEFINITION OF ELECTRICAL TERMS

#### Tables Covering

Decimal aquivalents of Fraction of an Inch.
Decimal aquivalents of Fraction of an Inch.
Decids of defiling numerary to remove gloss,
weather parts, etc.
Assuments of Deals for Tapping
Melting France of Metals
Piston Displacements
Wer and Sheet Metal Game
World Series Specifications
How o all Cartespetor sing
An Freezing Voluntary
Management Proces Required to Drive Marking
Tools

Equivalent Annular Ball Bearings Humpower Taide by N. A. C. O. Formula Grades of Grinding Wheels Gran Numbers Commonly used in vactors

Musical Appendicate Commonly Code of C

Tuper Research of Standard Taper Sockets Wirthich Stars for Holls, Nuts and Cap-Scored Continuous Drill Table



rrett Book for MACHINISTS AND AUTO REPAIR MEN

## How to Scrape Metal Surfaces

By H. L. Wheeler Machine-Shop Foreman

ALL bearing surfaces on high grade machinery must be scraped. We have only to consider the enormous number of machines turned out to realize how vast is the area of metal surfaces scraped each year in machine-shops. For this reason the art of scraping metals is an important branch of the machinist's trade; and it is an art that cannot be learned merely by following set rules. Perfection is acquired only through patient effort and continued practice.

Machined surfaces rarely are absolutely accurate, except, perhaps, work that comes from the granding machines, and even this, while appearing flawless to the naked eye, is not entirely perfect. Large flat or long parallel surfaces, whether planed or milled, are never quite true when they leave the machine. And where such surfaces are to function as a hearing for some other part of what is to be an accurate piece of mechanism, they



Fig. 1. Parallels and excepted test pieces used in the checking of milling machines

must be acraped and the mating part must be scraped to them. This scraping process compensates for the errors left by the machine and incidentally leaves a smooth surface.

Several attempts have been made to

necomplish this work by mechanical means, but up to the present time, success has not crowned the efforts of inventors in this field. Those who take up acraping as a specialty need have no apprehensions of being crowded out of a job by the development of a machine to do the work. It is one of the few hand operations that still haffles the ingenuity of inventive skill

In this article I shall describe the few simple tools used and some of the conventional methods employed in the work

At A and B, Fig. 8, are shown types of scrapers commonly used, the flat accaper

for fint work and the half-round scraper for cylindrical work, such as fitting bearings. These vary in length and width and slightly in shape, depending upon the nature of the work and sometimes the individual fancy of the operator

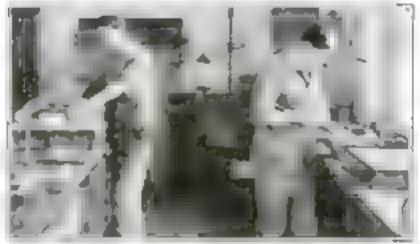
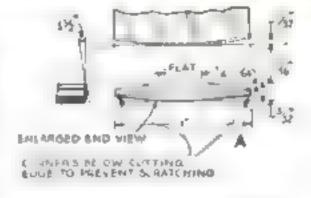


Fig. 1. Sporting work on a mariner plate at left, and a machance demonstrating current position for atroping at right;



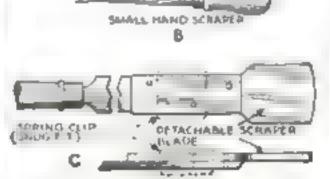


Fig. 3. Convex scraper canquerated) a best sing scraper and a detechable-blade acraper

Scrapers for fint work usually are made from % to 1% in. wide and about 1/16 in. thick at the end or cutting point, tapering slightly for 2 or 3 in. to the heavier section of the body, which is from 3/18 to 5/16 in. thick. The highest grade of carbon-too?



steel makes the best scrapers—about 1.40 to 1.50 carbon. They should be almost file hard, or as hard as possible without having a tendency to crack or crumble at the edge. A detachable blade scraper for finishing and light work is shown at C. The scraper is fastened to the long shank by means of three pins and a spring clip.

Opinion varies concerning the correct contour or shape for flat scrapers. Hold a machinist's scale at an angle and let the end come in contact with a flat surface. Note how the whole width of the scale bears from corner to corner. Now move the scale a short distance

while bearing down on it. The corners have a tendency to drag or scratch, do they not? If a scraper is ground so that the cross section at the cutting and resembles a scale, it inevitably will do the same thing. To get away from this objection, the end is rounded slightly as indicated at A

It will be noticed that this scraper has still another feature that enhances its cutting ability over the strictly flat scraper, which merely is rounded at the end. The cross section at this point is



Fig 4. Types of fronting used to ornament surfaces previously scraped to a true plane

slightly convex. This raises the corners from the surface even when it is held in a horizontal position.

It will be seen that this method of grinding makes it practically impossible for the corners to dig in at any angle. The end is ground diagonally from opposite corners and it is given a slight back rake—about 1th degrees. This gives to the cutting edge a free shearing action, which in-

creases the speed of the cut and reduces the resistance of the cut on the operator's hards and arms. An examination of the line drawing clearly shows the form for grinding, which may be accomplished to best advantage on a soft, wet grindstone.

however, that the convex form is not absolutely emential for a flat scraper. Some may prefer the perfect flat. In making the convex, indeed, it should be very slight, just enough to make the cutting edge in the center with about 1/4 in flat. In the drawing this has been exaggerated for the purpose of illustrating the idea. The center is actually only from

(Continued on page 80,



## For Assembling or Repairing Your Own

Here are the Files you need to simplify the job and assure proper results.

An 8' Round File-for enlarging boles in panel boards.

An 8' Cabinet File-for faulting ends and edges of wooden cabinets.

A 10' Half Round Bestard File-for smoothing peep holes in penel. A 10° Plat Filess-for smoothing panel edges and beveling.

A Tungstee Point Filefor surfacing contact
points.

A 6' Flat Bastard Pilo--for miscellaneous work.

Don't try to make one File do it all. It won't. But for every filing requirement, there's a NICHOLSON File, which in sharpness, accuracy and stamina is exactly suited to your purpose. Therefore---

He must be name NICHOLSON is stamped on the tang of every file you buy.

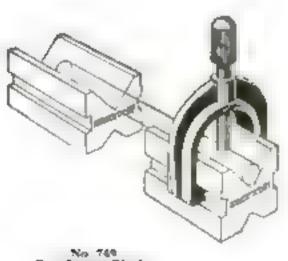
NICHOLSON FILE COMPANY (S)

Providence, R. I., U. S. A.

NICHOLSON FILES ~ a File for Every Purpose







Cast Iron V Blocks and Clamps You should see these tools. They're beauties. A mechanic would enjoy handling them, for somehow he would instinctively recluse that they "feel" right. The design, balance, clean-cut graduations and immediately recognized utility are features by which the skilled mechanic knows them to be tools made by master workmen. Furthermore, the name and trade mark of Brown & Sharpe assure him of the accuracy and durability expected of Brown & Sharpe Tools.

Stop at your dealers, see and handle these tools. You, too, will feel their "personality," and will be proud to have them in your kit

The New No. 29 Small Tool Garding

The new size catalog is most convenient ships right into the pocket casy to handle and above all it has a tools hat are of in facest to every machanic.

Brown & Sharpe Mfg. Co. Providence, R. l.

SEND TODAY FOR YOUR COPY OF THIS CATALOG

## Brown & Sharpe Tools

Standard of the mechanical world

#### How to Scrape Metal Surfaces

(Continued from page 84)

After grinding, the scraper is boned on an oilstone. The oilstone rests on a bench and the scraper, held in a nearly vertical position, is rocked back and forth over the oval edge a few seconds with pressure to give it a keen cutting edge. If the scraper is made of good steel and is properly tempered, it will tast a long time without regrinding and only an occasional rubbing on the stone will be needed.

Before scraping a job, the work must be spotted. This operation reveals the true condition of the surface, indicates the high and low spots, and serves to guide the operator. The high spots must be brought down to the same plane as the

low apots.

Several different materials are used for spotting. On the coarser grades of work red lead and oil may be used, but for very fine work Prussian blue is the best material. When using Prussian blue, only a very small quantity is required and in all cases it should be used sparingly; a piece the size of a pea will cover a very large area. Another point to hear in mind when applying any spotting material to the plate is that it should be distributed evenly. Thick and thin spots will result in a false bearing.

IN SOME cases the plate is applied to the work and in others the work is applied to the surface plate; the results is either case are the same. This is governed by the weight of the job. Where the work is of a light character, the usual practice is to apply the piece to the plate.

Hefore marking or spotting the work, all dirt and chips must be removed and the plate must be free from any dirt or grit. The piece is then placed upon the plate in contact with the surface to be worked upon. It should be moved around and turned in several directions on the plate without applying any downward pressure other than the weight of the piece, as in Fig. 1 at the left. At the right of that illustrated is shown the correct position of the mechanic and the method of holding the scraper

Considerable pressure sometimes is required on the accept to bring a job down to the proper surface within a reasonable time; this depends in some degree on the size of the job and the condition of the surface as left by the machine. It is understood, of course, that the push stroke is what takes the metal off the

high apota.

In some classes of work, such as acraping long machine beds and the ways of
lathes and planets, there is a peculiar
freakish tendency of the castings to warp
and twist after being machined. It is the
custom of some companies to rough off a
number of castings and pile them out of
doors for several months for "seasoning"
This relieves the atremes and strains.
Even with this careful process there is
often a slight warp or twist in the casting
when it comes to the scraper and this has
to be taken out with a heavy scraper and
lots of elbow grease.

Extra heavy work is set up on the floor Fig. 5). The surface plate should be Continued on page 88)



All out-doors invites your Kodak

Autographic Kodaks \$6.50 up

Eastman Kodak Company, Rochester, N. Y. The Kodak City



## Remington Portable

is the recognized leader - in sales and popularity



Take any user's advice and huy a Remington Portable

#### Remington Typewriter Co.

374 BROADWAY, NEW YORK Remodes Everywhere

July 4 m F 4

We believe we make the best typewriter ribbon in the world—and its name is PARAGON



#### Durability and Reliability

The Remington Portable has went the endorsement of the world by our manuscular durability and refutability You can count on it for yours and yours of faithful marrice.



#### Compactness and Portability

The Remarkton Partible is the most rempact of all wrong machines. When encased I is only I lacked high, so I can be tucked away in a deak drawer or book case. It weighs but if pounds, It carries its table op its back, which makes writing easy and convenient in any place or position, even so your lay.



#### Four-row Standard Keyboard

For fifty years the four-bank heybuild has been recognized as standard. The Herr ngives Portable has alunyo had the standard key cound, and four rows of key seems ab fring for figures—as nearly like the big machines.—The heyboard universally adopted by business as the best.

Keyboards in therty-freelanguages and for every occupational requirements.



#### East of Operation

You will be surprised how quickly you can master the operation of the Remington Fortable. The fourrow, standard keyboard, and the simplicity in design and construction of the entire machine make it accomparably may to learn and to operate.



#### Beautiful Work Always

The writing of the Remington Portable in unreptionally beautiful. Even a beginner turns out work that is a swelation. This, of course, is due to the fine construction of the machine, and its bubit of always being in perfect alignment.



#### Universal Service

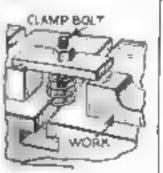
Wherever imaguage is written—on the ma continents—you will find lieutington service, for there are ever '10 Remination offices throughout the rive used world. A Rum ngtat. Portable owner brown that wherever he goes Remitagion service is near at hand. This feature is one that no portable typewriter better our afford to overlook.

On every count—whether work, wear or pervice—the superiority of the Remington Portable, decisive, field by over 5,000 dealers and Remington branches everywhere. You can buy one on easy terms, if you wish

Write for our illustrated,
"For You—For Everybody."
Address Dept., 67,

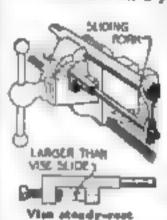
## Springs Save Time in Clamping Duplicate Parts

THE simple expedient of using springs under work clamps, as illustrated, has resulted in cutting down materially, in one shop, the time of setting up repetition work on planers. — A. L.



#### Support Steadies Long Work in Machinist's Vise

WHEN working on long material at the vise, it is often a considerable aid to use a support made as shown. This is machined from a piece of flat stock of



the desired length, one and being turned down to any suitable diameter and fitted with a citding fork or rest. In this way the end of the work may be prevented from sagging. This saves shifting the stock in the vise so often.—F. N. C.

#### How to Scrape Metal Surfaces

(Continued from page 86)

placed at a convenient height for the operator to use or hung on a chain hoist by a special grapple hook. When the plate is rested face down on a bench, it never should rest directly on its finished surface. A special board having leather or felt pads should be provided, or it may rest on another surface plate, face to face.

Scraping bearings also is illustrated in Fig. 5. In this work the interior surface of the bearing is scraped to fit the spindle. Sometimes a special mandrel is made and used as a master plate and in others the spindle is used directly for the hearing for which it is intended.

In Fig. 2 is a group of special test pieces and parallels used for checking scraped angular surfaces, such as the ways of lather and milling machines and the V's

Closely allied to the scraping of metal surfaces in the producing of the ornamental appearance known as frosting. This is an added refinement used when time and expense warrant in order to decorate the surfaces. The principal figures seen on frosted machine surfaces are indicated in Fig. 4.

The crescent pattern sometimes in varied by adding a second series of crescents, so that the surface is mottled with what appear to be full circular marks. In either case, the scraper is oscillated right across the surface to form a whole string of crescents at one time.

In forming the straight and diagonal diamond patterns, the mechanic draws the accaper toward him to make one broad mark and then passes it sideways to the right a tribe, preparatory to drawing forward again. To learn to do this is mainly a matter of practice,



far away places—is a most thrilling game. To many, it's more than helf the fun of radio receiving.

Success in this absorbing venture requires not only a good receiver but a beadest expuble of responding to faint agnale clearly and distmetry Such is the new supersensitive Music Master Headast 'It a equal to another stage of radio frequency one user said.

The Music Master Headact is to other head phones what the Music Master Reproducer is cally treated to rost proof them. Pole faces are ground to an accuracy of one-ten-thousandth of an each of each other, and the specially treated steel diaphragm is gauged to a half thousandth of an inch. All parts are accurately measured by the most delicate recording instruments known to science. Each finished pair must vibrate fully freely evenly and without rattle over the entire scale of audible frequency

And it is a handsome, comfortable set, maitery and enduring. Price-\$12

Music Master is the musical instrument of radio. Volume without disturtion. Connect as you would headphones. No batteries required, no adjustments, 14-inch model for the home—\$30, \$1 meh model for songerts and danoing—\$35.

Ask Your Dealer To Let You Try One

#### Music Master Corporation

Makers and Distributors of High-Grade Radio Apparatus 10th and Cherry Streets

PHILADELPHIA

Pittsburgh

# ILSIC aster

HEADSET



Music Master Loop Aerial in equipped with calibrated dialy covers the entire hand of broadcasting wave lengths. Price-510.



#### A small vise-

## with jaws like a bulldog's

A VISE to judged by its jaws. They're "the works."

Find a vise with jaws that meet flush and true won't wobble or loosen, hold with equal strength at all points and with the tenacity of a buildog and you've found a vise that will be a real helper for all the years to come.

This Goodell-Pratt Vise is that kind

Clamps to any bench of less than 13f-inch thick ness. Operated by an accurately cut steel feed screw. The two steel guide rods hold the jaws rigid

All parts carefully fitted—the final operation being the close machining of the jaws to make them meet with absolute accuracy

Steel parts are polished. Iron parts beautifully finished with enamel, baked on.

Wighth of jaws, 2 inches; Jaws open, 2 inches; weight, 336 pounds.

#### Other tools for the small workshop

In the Goodell-Peats family of 1900 Good Tools are many other such tools made specifically for the small workshop. The eatalog shows them all. Write for it. Just ask for Catalog No. 15

QUODELL PRATT ( CREENFIELD, MASS, U.S.A.

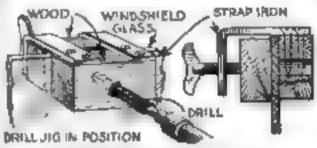
Joolsmith:

Mathera of Mr. Panch

# GOODELL-PRATT

#### Simple Jig Prevents Breakage in Drilling Plate Glass

IN DRILLING plate glass for attaching windshield wipers, special inside spotlights, and similar purposes, the simply made drill jig illustrated has proved successful in preventing breakage. It consists of 2 blocks of wood, 2 small pieces of



The drilling tool is guided by a wooden. block classped firmly against the gloss

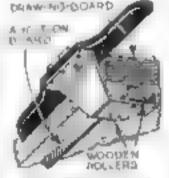
strap iron, 4 wood screws and 2 damp screws.

The jig will serve with whatever type of tool is used for drilling the glass. Usually the tool is a file or a specially hardened steel drill kept wet with turpentine and camphor, or else a brass tube with an abrasive of turpentine and emery powder.

#### Roller Guide for T-Square

TO HOLD a T-square against the lefthand edge of the drawing-board at all times is the object of the device illustrated. This is especially intended for

> use on a large drawing-board not equipped with an ordinary parallel rule attachment



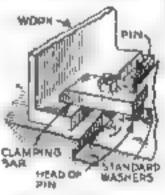
Keeps T-square head against drawing-board

A bent plate somewhat shorter than the length of the T-equare head is fastened securely to the head. This plate carries a pair of wooden rollers. The rollers run

against a track made of a bram angle, which is fastened to the under side of the board parallel with the edge.

#### Extension Blocking for Planer

A grany of us know how aggravating it is to have a job blocked and clamped on the planer bed only to have the blocking slip on the first stroke. A good way to prevent this is to make a pin with



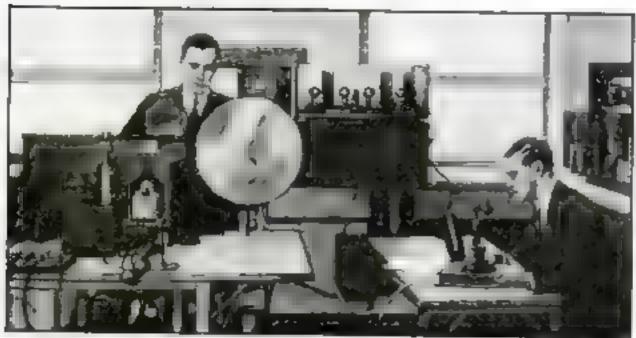
Ordinary washers are

a large head, provide the clamping her with a hole through which the pin will pass, and use standard washers between the clamping bar and the pin head to act as spacers. Much time can be saved by using a set of these clamps in conjunction with a keg of 1- or 1 14-in, washers.

How to Use a Universal Dividing Head, is a Better Shop Method article that will appear shortly







in one field System data reprints again to remain my recorded up the modificance and a section in their contractions.

## The service of knowledge

The youthful Alexander Graham Bell, in 1875, was explaining one of his experiments to the American scientist, Joseph Henry. He expressed the belief that he did not have the necessary electrical knowledge to develop it.

"Get it," was the Inconic advice.

During this search for knowledge came the discovery that was to be of such incalculable value to mankind.

The search for knowledge in whatever field it might lie has made possible America's supressacy in the art of the telephone.

Many times, in making a national telephone service a reality, this centralized search for knowledge has overcome engineering difficulties and removed scientific limitations that threatened to hamper the development of speech transmission. It is still making available for all the Bell companies inventions and improvements in every type of telephone mechanism.

This service of the parent company to its associates, as well as the advice and assistance given in operating, financial and legal matters, enables each company in the Bell System to render a telephone service infinitely cheaper and better than it could as an unrelated local unit.

This service of the parent company has saved hundreds of millions of dollars in first cost of Bell System telephone plant and tens of millions in amount operating expense—of which the public is enjoying the benefits.

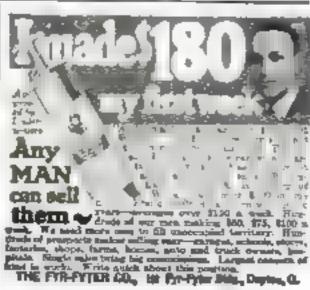


AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

#### BELL SYSTEM

One Policy, One System, Universal Service

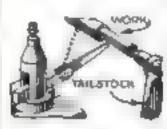




#### Telltale Aid in Setting Work for Taper Turning

FOR setting over a lathe tailstock for cutting tapers, the simple telltals illustrated is a useful accessory. A piece of machine steel 1/2 by 1 in, and about 5 in, long is slotted as shown to take a finger made of 1/2-in, thick shoot steel pivoted on a 1/2-in, pan.

After the spots are turned on the work for the large and small diameters of the

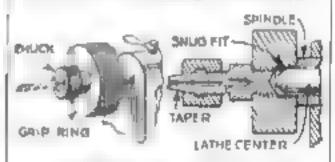


Lethe telltale

taper, the finger is placed in the tootpost and the taisstock in set over until the finger just to us how each turned spot, the carriage being run back and forth.

#### Tailetock Holder for Light Drilling on Bench Lathe

ON THOSE frequent occasions when it is desired to drill a center or a small hole in work chucked in a banch lathe, the usual practice is to remove the part and do the drilling on a drill press. One way to avoid taking out the work is



A ring that slips over the tallstock center holds centering counterink or small drill

to use a hand drill holder that is inserted between the work and the tailstock center.

This holder consists of a grip ring knurled on the edge and drilled in the rear face to fit enugly over the tailstock center, so that the rear face of the ring bears against the spindle. This insures the ring's being located centrally to the work Screwed into the front face of the ring is a chuck for the centering countersink or small drill.

#### Diagonal Pins Hold Tools in Socket of Unusual Design

TOOL socket A that differs from the conventaunal type can be made ипежрепgively an Bitentrated. It consists threaded bolder and nut with a closed end. Two diagonal holes are fitted, sa indicated, with pins that are forced

LOOSE PINS

The societ and cross section, showing pens

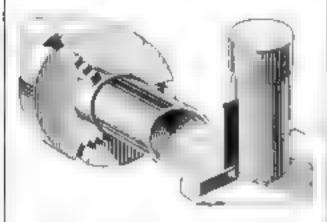
against the shank of the tool when the nut is tightened. For some purposes a single pin is sufficient.

For use in lathe or drill press, this form of tool can be made up at comparatively small cost, and it is suitable for taps, drills, counterbores, reamers, and various other cutting tools.—G. A. L.

#### Testing Alinement of Lathe and Accuracy of Square

TO DETERMINE accurately if the live spindle of a lathe is true with its ways, I shuck and turn a piece of metal of convenient diameter for a distance of 6 or 8 in. If the diameters at both ends of the cut are equal, then the spindle is true in a horizontal plane. In turning off this section, the last tool cut must be very light so as to reduce the wear of the tool to a minimum. For greater accuracy it would be well to grind the surface after it has been turned.

Checking the trueness of the spindle vertically in relation to the ways, an in-



The special test piece used for checking d lethe spindle and lesting a square

dicator is placed in the toolpost and traversed beneath the turned surface Lack of movement of the indicator shows that the lathe spindle is almed correctly

This same piece of stock can be used to test the accuracy of a square. First turn a conical center in the and of the metal. then bring the tail center into the turned center in order to true the tailstock and spindle. Now form a narrow flat edge on the end of the piece and place it on a surface plate, as shown.

A square, or any other right-angled tool, can be tested very quickly in this WAY -JAMES F HOBART

#### Tool for Cutting Washers

WASHERS of any desired size may be cut rapidly from rubber, fiber, felt. or any material other than metal with a tool made as shown.

Between the cutting edges is a recess that contains a ring for ejecting the

washers so they are cut. A ring of The the same diameter are ejected is placed outside the tool on top and connected with the by inner ring means of two studs. These studs carry springs, so that each time the spindle is rused the washers that comme have been cut are



automatically forced out of the tool Tool steel should be used. The edges may be resharpened without altering the size by grinding the bevol. The shank of the tool is held in a drill chuck or made with a taper shank, as preferred.

The material to be cut is placed on a board so that the cutting edges will not be dailed.—H W



## We've Made You

A Unique Shaving Cream Will you please accept a test?

By V. K. CASSADY, Chief Chemier

Gentlemen:

Here is a Shaving Cream which millions are discussing. It does five things which men desire in a surpassing way.

The history is this:

Palmolive Soap, through its effects on the skin, had become the world a leading toilet soap. We desired to bring men those same effects in shaving.

But men, we knew, wanted other results. So we asked 1,000

men to tell us what they wanted most.

Then we worked 18 months to meet their requirements as no one else had done. We made up and tested 130 formulas to attain the utmost in a Shaving Cream,

Five astonishing results

l Pulmolive Shaving Cream multiplies itself in lather 250

2-It softens the beard in one minute.

- 3--Its lather maintains its creamy fullness for ten minutes
- 4-The extra-strong bubbles support the hairs for cutting. 5-The pairs and olive oil content makes the cream lotion-

like in its effect. The result has been a sensation.

To add the final touch to shaving luxury, we have created Pelmolive After Shaving Tale—especially for mon Doesn t show Leaves the skin smooth and fresh, and gives that well-groomed look.

There are new delights here for every man who shaves. Please let us prove them to you. Clip coupon now.

THE PALMOLIVE COMPANY (Del. Corp.), 360 N. Michigan Ave., Chicago, III.

PALMOLIVE SHAVING CREAM



#### 10 SHAVES FREE

and a can of Paterolive After Shaving Tale

Simply insert your name and address and mad to

Address for residents of Whatmosia, the Paramiltee Company, the Comp. Malecules, Wh. Dept. 8-846, Address the residents of the han Wissenstein. The Calmulius Communy. Del. Comp., 340 North Michigan Avenue. Chicago, Ill., Dept. 8-846,



It's worth while spending a little time, when you pick a pher for your kit. Ask your hardware dealer—he knows a lot about tools. And if it's quality phers you buy, he will probably tell you to take a leaf out of the professional electrician's book and buy Klein's. There is sixty-seven years of experience built into every Klein pher—aixty-seven years of manufacturing only quality tools!

AM BELMONT AVENUE CHICAGO, ILL.



## Mathias KLE & Sons

#### Making the Most of Your Milling Machine

(Continued from page 82)

to be done except to mill this radius. It was eight o'clock in the morning and I had only six hours in which to machine the 60 pieces, but this looked easy enough, as I only needed to do 10 pieces an hour

I went to the tool crib and asked for a concave radius mill with \( \frac{1}{2} \)-in, radius, but after looking all over the crib, the tool man said he had nothing but a \( \frac{5}{16} \)-in, radium mill, so I was stuck. After a few minutes' thought, I looked up a block of cast iron of the form shown at \( D \), turned up a stud, \( E \), and inserted it as shown, then clamped down the block on the table of the milling machine. I centered the plug with the spindle as indicated. Next, I threaded a \( \frac{5}{16} \)-in, rod 12 in, long for a handle and put in a 1-in, and mill \( (F \)

Screwing the handle G into the rod-end G and placing the latter on the stud B, it was an easy matter to move the handle back and forth in the direction of the arrow and thus generate the radius required. As a matter of fact, I had the 60 pieces done a few minutes before noon, although some of them were a trafe rough. I touched them up with a file and removed the burrs, finally making a good job.

When I took the work to the foreman, he wondered how I had done it so quickly, and asked where I got the radius mill. I took him over to the machine and showed him the rig I had used. It developed later that the foreman knew there was no radius

mill of the right size In the tool crib and had given me the job purposely, to see how l would make out. Incidentally, E recelved an increase in pay the next Saturday, presumably for the ingenuity displayed.

The or-

dinary

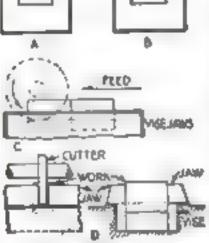


Fig. 4. Milling a slot

milling-machine operator seldom stops to think that it often pays to take a little more trouble and set up two or more pieces at a time. Prequently they may be machined almost as quickly as one could be done. Take the example shown in Fig. 2. There were 50 shafts (A) in which keyways were to be cut as at B. Many operators would set up one piece at a time and clamp it in the usual way against a parallel in the T slot, but by using blocks as shown at C and a single clamp between the pieces, they could be set up almost as rapidly and located as positively. Then, by using two cutters on the arbor, the production almost could be doubled.

A thin easting is always hard to hold and difficult to machine. "Chatter" is

(Continued on page 95)

### Start with Their Early Training

You can bring up machines to work fast and profitably, much as you build up good workmen.

By using a counter and getting a record, you can check up the output and GAINS in output as you perfect your machine mechanically.

You'll develop better operating methods—and a better operator at the machine, Each new step, as it counts in results, will be measured for what it's worth—by your



The small Revolution Counter below registers one for a revolution

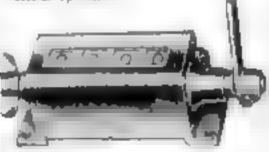
> of a shaft, recording a machine operation, or product. Though small, this counter is very durable;



its muchantem will stand a very high rate of speed, making it especially sustable for light, fast-running machines and most adaptable to experimenta, work, if run backward the counter sub-

tracts. Price \$2.00. (Cut 4.5 stee.) Small Retary Reschet Counter, to register reciproceting movements of speal) machines, also \$2.00.

The Revolution Set-Back Counter below records the output of the larger resolution where a shalt-revolution indirectes an operation.



Sets back to zero from any figure by turning knob once around. Supplied with from four to ten figure-wheels, as required. Price with four figure-whisels so illustrated. \$10.00—subject to discount. Cal less then one-half size. Set-Back Rotary Ratchet Counter, to record reciprocating movements as an punch presses. \$11.50 (list)

Everything you need in a counting device goes to make up the 30-page Voeder booklet. You'll enjoy secting a copy; gladly sent free.

The Veeder Mfg. Co., 44 Sargeant St. Hartford, Com.

PYANKEET Radio Drill No. 1431

#### Making the Most of Your Milling Machine

(Continued from page 94)

very apt to develop on this kind of work. If you clamp the piece too strongly, you are very likely to spring it out of shape and if too loosely, it wil. chatter or change

position during machining.

Take the piece shown in Fig. 8 for example. This is a thin bronze casting, A, which is to be face milled on the flange B. We first set up this piece by means of set-screws in surrounding angle plates as indicated and started the cut. Before the mill had traveled 3 in., a persistent chatter developed, at which time the machine was stopped and setscrews tightened again. Helore the first piece was completed, we had to stop the cutter four or five times and tighten

the setscrews. We
were using
cone-point
screws and
changed
them to the
cup-point
variety,
which improved the
situation
slightly, but
we were

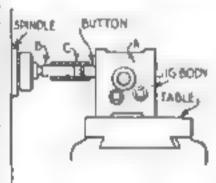


Fig. 6. Locating before with slover and butters

obliged to use a very light feed and high speed to prevent chatter. This made the operation slow and some distortion was apparent.

The trouble finally was overcome by using wooden blocks and jacks at C and D opposite the setscrews. By this means vibration was overcome and the screws could be tightened sufficiently to held the work without causing distortion. A principle similar to this often can be used to advantage when holding thin or fragile

When you have occasion to cut a slot through a casting or a forging, as shown at A in Fig. 4, you are very likely to produce a result as shown in exaggerated form at B, in which the sides have aprung away from the cutter during the process of machining. If you put the piece in vice laws, as shown at C, and mill through the slot lengthwise of the jaws, trouble will be caused by the cutter's binding and giving an inaccurate slot when finished. If you cut crosswise of the jaws, you will have a result similar to that shown at B

Several solutions are possible in a problem of this kind. If you have only one piece of machine, you can take a cut through the center first and then a light finishing cut on both sides, using a rather high speed and fine feed. The operation can be done with a single cut by using special jaws as shown at D, high enough to support the sides well and obtain a good grip to prevent spring. If there are a number of pieces to be machined, this is, of course, the best way to do the job; but if only a few are to be made, it would hardly pay to make up jaws specially

When using a milling machine for the accurate boring of holes, as often required in jig work, care must be taken in setting

(Continued on page 90)



## "YANKEE" Radio Tool Set No. 105 Price \$3.25

tion to use on your radio, you will find these

tools handy for general use around the house.

All these attachments fit "I ankee" Ratchet Hoider, Blader—one for long reach into box, between wires, etc.—one for small acrews on dials.

conterent for heady of screws

Counterent for heads of screws

Socketa—itwol cover all small nuts.

Reamer—for calarging holes in panel.

Wrench—one cod, aquare or hex. Other, bez for jacks.

Unter Bender—for heading were and making loops.

#### "YANKEE" Drill No. 1431 Price \$3.00

4 to 1 gear for speed. Specia Radio Chuck to take largest drill usually supplied with radio drill acts.

Your dealer can supply you

"Yankee" Tool Book Free on request

NORTH BROS. MFG. CO., PHILADELPHIA, U. S. A.

## YANKEE" TOOLS

Make Better Mechanics

## Williams **Shaving Cream**



## Gven the cap was designed for speed

If you like to make race track speed in the morning, Williams Hinge-Cap will appeal to you. Slappery fingers can't drop at. Carelessness can't lose it. For the cap's hinged on. It simply can't come oft.

As for the shaving cream, it was designed especially for men with wiry beards and tender skins.

Williams works up into a rich, creamy lather almost instantly. And as the razor gixles across your face you experience a new sensation. Each stroke is lubricated. Razor friction is removed. And when the shave is over, your face feels clean, cool and delightfully refreshed.

Try Williams tomorrow morning. Large size, 35c. Double size, 70c, contaming almost twice as much cream.

#### THE J. B. WILLIAMS COMPANY Glastonbury, Conn.

The J. B. Williams Co. (Consola) Ltd., St. Patrick No. Montrout.



E'VE scored again! Again Value is the new product—a stientific preparation for use after shaving. For free trial bottle, write Dept. 109.

#### Making the Most of Your Milling Machine

(Continued from page 95)

from one hole to another. It is seldom advisable to depend upon the micrometer dials on the machine, although these may give a close approximation to the sizes. The majority of operators are more or less familiar with the button method of locating holes that are to be carefully bored in

a given relation to each other

In applying this method to the milling machine, if we sasume that the work has been earefully laid out and the button applied, the piece can be set up on the machine as indicated at A in Fig. 5. After this has been done and the piece clamped against an angle plate or on the table, according to requirements, we must provide a hardened and ground plug  $B_r$ lapped accurately to the exact size of the button used. This plug is inserted in the spindle as shown, and a sliding sleeve, C, is placed over it. This sleeve must be a very nice fit, without any shake whatever

In use, the table must be adjusted until the sleeve can be slipped freely from the plug over the button, at which time it is evident that button and plug are in alinement. Back-lash in feed screws must be taken out when alining button with alseve, and if the former is a trifle higher than the plug, lower the knee below the required point and then bring it up again, to take up all lost motion in the screw. In making longitudinal adjustments, the same idea must be followed.

A FTER the spindle is out, the button and plug are removed and a drill is inserted in the spindle, to be followed: by the usual boring bar or reamer. It is always best to generate the hole accurately by means of a boring tool, me the reamer may be slightly off center and thus cause slight errors in the position of the hole. A careful operator can obtain very good results by this method, although some prefer to mount an indicator in the spindle and obtain the setting by adjusting the table until the indicator reads the same at four points 90 degrees apart around the button. It is rather difficult to see the indicator pointer in some positions, but this difficulty can be overcome by using a small mirror and an electric light. As a general thing, this method of location produces more accurate results than the plug and alceve arrangement.

For short jobs, don't worry too much about your feed and speed, because the cutting time is less important than the setting up. Use a conservative feed and speed and spend your time to the best advantage by studying out a simple and accurate method of setting the work in position and holding it there when you have placed it properly. Ordinarily use slow speeds and comparatively coerse feeds for roughing cuts, with higher speeds and finer feeds for finishing. Chatter often can be avoided by changing the relation of feed and speed.

Cast from usually is cut dry. Bronze and aluminum can be cut either dry or with a lubricant. Tool steel or alloy steel and steel castings are best cut with a lubricant. Plain lard oil is very good, but

(Continued on page 97)

## RADIO

#### Elements of Radio Communication

E. W. Stone

For the man who wishes to understand the general theory of radio communication. A complete, up-todate ducusion presented in completerms, of every phase of radio-telegraphy and radio telephony.

Price, postpaid, \$2.50

#### Henley's 222 Radio Circuit Designs

An entirely new and thoroughly practical book on radio circuit designs. Contains the largest collection of radio circuits and hook-ups ever published.

Price, postpaid, \$1.00

#### The A B C of Vacuum Tubes Used in Radio Reception

E. H. Lespie

Written particularly for the person who 'knows nothing about radio" but who would like to gain an understanding of the elementary principles of operation of vacuum tubes and variount sen is nwitch they are used.

Price, postpaid, \$1.00

#### to Build Your Radio Receiver

Edited by K. Banning and L. M. Cochaday

This book tells just exactly how to build your own receiving net, how to metall it and how to operate it. Full detailed instructions are given for hadring seven different receivers, the receiving radius of which ranges from fifteen to over three thousand miles.

Price, postpaid, \$1.50

#### International Cram's Radio Atlas

Double page Radio maps of the nited States, Canada, the World. Hr ladeasting stations of the world with the language, wave-lengths and ownersh p. Comeral Radio informa-

Price, Fifty Cente

#### Cram's Radio Map

A commendensive Radio Map of the United States and Canada, showing government, commercial and private sta tons: completely tadested. Size

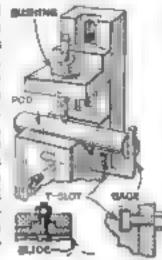
Price, Thirty-five Cents

#### Popular Science Monthly 250 Fourth Avenue,

New York, N. Y.

#### Adjustable Jig for Drilling Holes in Round Bara

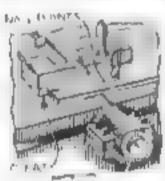
A CHEAP and yet accurate pg for drilling holes in round stock can be made as illustrated. A square block, provided with a V-groove, is fastened to the upright by means of a T-alot. The upright is grooved to allow the bushing bracket to be a djusted up or down,



A 34- or 36-in, hole is drilled in the end of the block to receive a bent rod, which acts as a gage. The gage is held in any desired position by a setscrew.

#### Safety Handle for Jointer Holds Thin Stock Firmly

WHEN planing thin strips of wood on the jointer, the danger of accident may be reduced by providing a handle or holder made as shown. It is placed over the strip to be planed, the end of which is caught against the cleat. The



Holds thin stock femily under pressure.

latter may project 14 or 14 in. below the lower surface of the holder, as desired. Two sharp pointed sails which project slightly through the holder, prevent the strip from moving sideways under pressure.

#### Making the Most of Your Milling Machine

(Continued from page 96)

for very hard materials white lend and oil give a smoother cutting action and this composition also has the property of clinging close to the cutter and adhering to it more than does plain oil.

In high production milling, a compound usually termed "sods-water" often is used, but for short-job work machines are seldom provided with pump and tank needed for this sort of lubrication. It should be remembered that the lubricant serves two purposes, reducing friction and rooting the cutter. For short jobs we need it mostly for reducing the friction and making the cutting action easier

Many operators deslike using lubricant on a miling machine because the oil and chips cling to both cutter and work and make it more difficult to see the action of the cutter. When the lubricant is used only in small quantities, it has no force and being only a small stream it does not carry away the chips. Likewise the chips and oil muss up the machine. This is a lazy man's point of view and should not be tolerated by a good operator, for it is certainly much cheaper to spend a few minutes in cleaning up the machine than it is to regrind a cutter.



# "Red Devil" Glass Cutters The Glaziers' Standard I''s economical to do the little home glasing jobs yourself with a "Red Devil." The hand hencel steel cutting wheel cuts clean and sharp, with More "Red Devil" Glass Cutters used than all others—try one and

see why Ask your hardware dealer for "Red Dovil' Glass Cutter No 024, 20c sech If The temperature of tempera not in stock, send dealer's name. FREE: HELHANCE Soith & Hemeroxy Co., Inc. been the same being and the property of the party of the 1889 of Res special Tombs 364 Streeting, Mary Park, N. P. Stalling C. Shoot "Red Don't Phone, Bete, Frames Saw and Bloder Screw Drivers Chain Dellis, Chipple and Pomber Decretans Larence Tools, etc.

### At last! a 100% Wood worker



E inch Circular rip com

E inch Circular eross sur sam

If inch Band sam

4 inch Jointor Shaper

10 inch sandar

intho-10 inch swing

PARKS Cabinet Shop Special is as complete a small shop equipment as you can buy! Everything is one compact unit with motor!

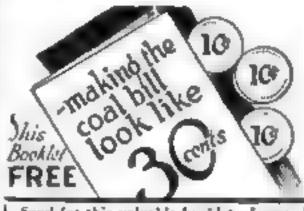
Just the machine for your home shop—for the cabinet maker—novelty and toy-maker—special farniture builder—for the farmer who makes his own crates bec-haves, etc. No end to its usefulness

Complete, or without motor and at-

Write for signifier

The Parks Bell Bearing Machine Company 3547 Knowleton St., Checkmonts, G., Entster Fedor 20 Mars Dam Ent, Haring, Co.





Send for this valuable booklet, Learn how you can cut down your coal-bills 20 to 50%—get more heat from less coal—firs the furnace fewer tames—decrease the amount of sales—reduce mote. All this by quickly attaching a simple incapenitie device to the feed door of your turnace. More than 14,000 houses know the comfort and feel strings made possible by

The CROWN Fuel Sever



GUARANTEED to make at large a 10% and saving or your destroy back.

This generates into all your work and at largely to control of the form of the saving the saving of the saving the saving the saving of the saving of the saving and the saving the saving of the saving

C. F. S. Co., 16 M. 10th St., Statement, Inc., Distribusoritories in a NTEO-High-grade man who made related increase. Write or wire.

#### Large Cap Prevents Speed Lathe from Splashing Oil

ANY one who has been spinshed with oil thrown by the spindle of a wood-turning lathe will appreciate the method of protection indicated in the accompanying illustration. The bearing cap is made about 1 in, longer than the lower half of

FLANGES ON CAP

the bearing. This allows 1/2 in to project on each side, the cap being cut back to allow the hubs to revolve under it.

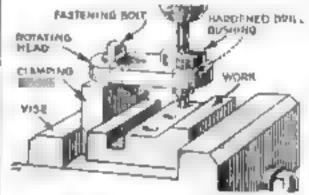
If the expense of making new caps is to be avoided, a piece of the fastened on each side of the cap will serve the purpose,—F. N. C.

Two types of all guid

#### Adjustable Drill Jig

THE simple drill jig illustrated is a useful fixture because it can be adjusted to suit the location of various holes that have to be drilled in straight flat work and shafts, as well as pin holes in stude and similar work,

A rotating head is pivoted to a block that can be clamped along with the work in the drill-press vise. A bushing hole is



The Re is adjusted by sliding the clamping block and retating the head

provided in one end of the head to take drill bushings of various sixes.

In use, the jug is clamped as shown and the head with the proper bushing is manipulated until it is directly over the proper apot, the adjustment being obtained by all ding the jug block along the vise jaw. The fastening bolt and the vice screw then are tightened to clamp the jug in place.—G. A. L.

#### Holder for Surface Filing

A TOOL for the mechanic who has a great deal of surface filing to do can be made by bending two pieces of 1/2 in. plate to form a file holder

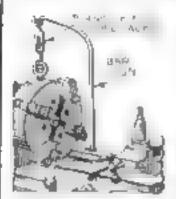


as shown. The plates are beld spart by a separator and two wooden handles are riveted to them. The central clamping bolt is acrewed up tight to hold the file between the jaws.

To anneal high speed steel, heat slowly to a dark red, cover with lime or ashes and allow to remain until cold. It can then be worked as anft steel,

#### Lift Attached to Lathe for Handling Heavy Chucks

REMOVING a beavy chuck from a large lathe is a task that is lightened greatly by the use of the special lift islustrated. When the design of the lathe permits, this may be fastened directly to the



Allows one man to handle large check

back of the bed, or it may be carried down to the floor and braced from the lathe bed

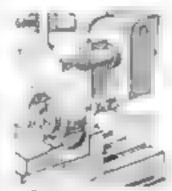
The upright is a beat bar iron with a booked end. This supports either a short turnbuckle or, if the stand is bigh enough, a small rope tackle. A hole is drilled and tapped in the

chuck to receive an eye-bolt.

When removed from the rest, the chuck may be swung to one side and allowed to hang ready for use when wanted. This allows one man to handle a beavy chuck.

#### Shaper Tool for Keyways

WHEN no regular keycutting machine is
available, keyways
may be cut quickly
in the shaper with
the tool illustrated.
The holder, forged
to shape as shown,
has a ½-in, reamed
hole that takes the
tool har. In the
end of the bar is a
toolbit, held with a



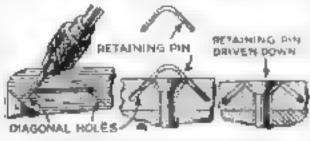
Cutting beyong to

setserew. If the holder is pack hardened, it will give and wear longer

Bars can be made of different lengths and sizes. For work on short bushings, gears and small pulleys, this tool-holder is a real time-saver

#### Lock Pins Prevent Turning of Countersunk Screws

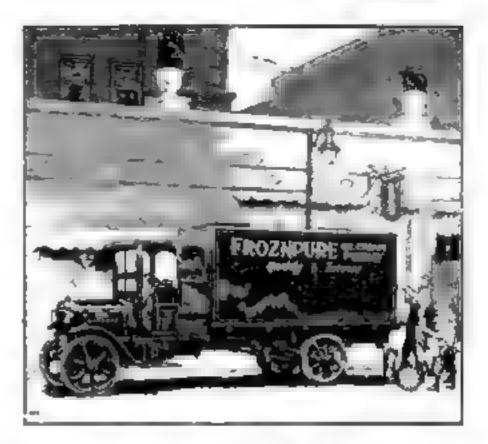
THE countersuck screw is one fastener for which ordinarily no method of speking is provided. In some cases, it is true, the head is chuseled, giveted, or prick punched, but these methods cannot



A musil pent steel red is driven into diagonal holes to lock the screw-bend slot

he depended upon always to hold against vibrotion and other strains.

In one shop countersunk screws are locked by the simple but effective method distrated. Two small holes are drilled diagonally at the ends of the screw slot and into these is driven a steel rod of the same diameter, which straightens out into the screw slot and holds the head.



# General Motors Trucks

## GMC Is The Big Mileage Truck

There is hig mileage in every General Motors Truck.

Big mileage free from anything but casual service attention. Overstrength in every part.

Long miles fully loaded up steep grades through bad going —bad roads or good look the same to the now famous GMC Two Range Transmission. It enables a GMC and its load to go anywhere the wheels can get traction.

Big mileage on gasoline and oil. The Two-Range Transmission furnishes both speed and pulling power with an engine of economical size.

Big mileage per dollar of cost. GMC Trucks are closely priced—cost less than other trucks of competitive quality and comparative capacity. Ask why!

Big mileage without dead time in repair shops. Ask for a catalog and see why!

GENERAL MOTORS TRUCK COMPANY

Distance of General Meters Corporation

PONTIAC MICHIGAN



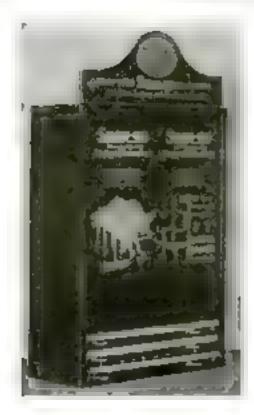
General Motors Truck Co. Pontine Michigan Department 47

Gentlemen:

Please send my further information. 5 nm interested in a (truck) idealership).

Name

Address



## Look for this cabinet at your dealer's

If your dealer has this Snapon cabinet, he is ready to give you real wrench service for your car. He can supply you in a jiffy with a wrench for one job, or a Kit, like the one below, specially selected for your car. Write us if he hasn't the cabinet. We'll serve you and him, too.





MOTOR TOOL SPECIALTY 14 E. Jackson Blvd., CHICAGO

Please and me bill perfectors about Scap-on Kit and the second territories and the second Mechanic's Lit, check here

I buy took from

Name

Address

## Easily Built Aquarium and Stand

SMALL aqua- By William J. Edmonds, Jr. ture well and let it rium lends a touch of color and interest to a sun porch, living-room or dining-room that well repays the cost and labor of hulding one. Not only has it a decorative quality that is difficult to duplicate by other means, but it provides a fascinating study for the children. Its revelations become more interesting the longer it is left unagitated, and for that reason the aquarium illustrated is of such a size that

To construct it, first obtain about 18 ft of 34 by 14 by 14 in. angle iron for the frame (Fig. 1). This may be bought at any hardware shop or dealer handling iron and steel; it should cost about 50

it can remain undusturbed for some time

The ends of the horizontal rule, A. should be beveled at 46 degrees with a hacksew and finsahed with a file. The pieces then are drilled for \$/16-in, rivets. These bales are not countersunk.

The vertical or corner pieces, B, next are cut and drilled, as indicated, and the holes are countersunk on the inside for the rivets. The holes in these pieces should be marked according to the holes already drilled in the horizontal pieces, A It also may be well to mark each piece so

that the pieces will be assembled in the same order as they have been laid out

When the frame is together, it is taken to a glazier and fitted at the rides, ands, and bottom with 13-in, plate or double thick window-glass. bottom giass should be a good fit, but the sides and ends should be slightly shorter to allow the cement to be pressed into the joints to form a dovetail, as shown in Fig. 1. The space marked C, which is found between the glass and the borisontal pieces, should be filled with cement, for if these spaces



The completed aquartum on its wooden stand.

TABLE TOP SQUARE 1

Fig. 2. The stand with dimensioned details of the top rails, legs, and stretchers

LEGS (D)

were allowed to remain open, the pressure of the water might spring the glass and cause a leak at the corner joints.

The cement is made as follows: Latharge, fine dry white sand, and plaster of Faris, each 3 parts, and fine pulverized resin, I part, are mixed together thoroughly with boiled lineeed oil, to which a little drier has been added. Beat the mix-

stand 3 or 4 hours before using. When the glass has been cemented in place, the aquartum is left to dry for 8 or 4 days before water is placed. in it, and 3 or 4 changes of water are then made, allowing 1 or 2 hours between changes before any stock is put in

The frame is finished in any color enamel destred.

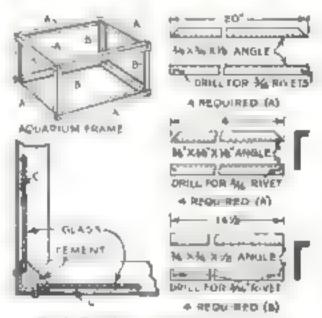


Fig. 1. Details of the squartum framework and method of consenting the glass to place

This agustium, of course, can be placed on any convenient table or stand, but it looks particularly well when set upon a stand made apecially for it as illustrated. This stand is very simple in construction. The top, A, Fig. 2, is made of two or more pieces of stock dressed 🌃 or 🥍 in. thick and glued together. It is advisable for the amateur woodworker. to use at least 4 dowels in each Joint.

The upper rails, B, and the lower rails or braces, C, are of the dimensions given. These pieces have tenone cut on the ends to fit mor-

tues in the legs. The legs, D, are dressed to 14 in, square and have mortises cut as shown. After the pieces are cut and have been fitted together, the joints are made with a good grade of glue and the top is fastened in place by means of wood screws passing through the upper rails into the top, holes first being bored to allow the beads to pink into the rails. Table-top fasteners, which can be obtained at a hardware store, or wooden blocks, may be used for holding the top if the bunder prefers.

After the stand in assembled, it is cleaned with sandpaper or, if made of hard wood, scraped and sandpapered, and then given a coat of stain and filled. It is then shellacked and waxed or varnished.

Stock for the squarium may be purchased from any dealer in aquarium supp.ies, or may be selected from slowrunning streams or ponds.

An article by Mr Edmonds on building a mission rocker is scheduled for early publication.

#### Blueprints for Beginners to Be New Workshop Feature

"I CAN'T build any furniture," recently remarked a friend to the Home Workshop Editor of Popular Science Monthly. "I haven't the time nor the tools nor the knowledge. Manual training (wasn't taught in the school i attended, and I never learned to do anything but ordinary little woodworking jobs around the house. You show me semething that

looks really well and yet can be made without mortises and tenons and dovetails and dowels and a whole lot of time - consuming cabinet work!"

It was a diffcult challenge, yet one long

foreseen. Indeed, the Editor had husenswer ready. It was in the form of a drawing for the first of a new series of blueprints for beginners—a design for a radio cabinet calling only for simple butt joints and workmanship of the most elementary kind. Yet this cabinet has a finely figured, veneered case as well as the overlay type of ernamentation and two-tone finish now so popular. The design and working details will appear next month

#### Complete List of Blueprints

ANY one of the blueprints listed below can be obtained from Popular Science Monthly for 25 cents. The Editor will be glad to provide, upon request, information relative to tools, material, or equipment. Blueprint Service Dept.

Popular Science Monthly

250 Fourth Avenue, New York.

GENTLEMEN

Street

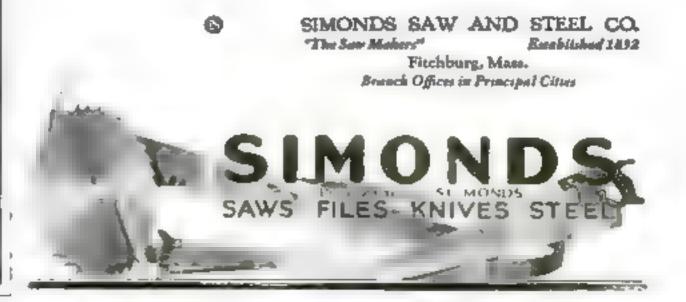
City and State

Sendmethebiueprint, or blueprints, I have underlined below, for which linclose cents.

T CHETCHO CETA		TORO CCITORI	
	Mal.	Title	Price
	1.	Sewing Tuble.	. 15c
	2	Smoking Cabinet.	. 15c
	Ì.	Book Trough End Table	35¢
	В.	Kitchen Cabinet	. 35c
	6.	Ritchen Cabinet Two-Stage Railio Receiving Bet	35c
		Bhaving Cabinet	25c
	9	Arbor with Gute and Beats.	75c
	10.	Porch Swing.	25c
	33	Banch and Tilt Top Table	250
	12	Esectric Weshing Machine.	25c
	13.	Tea Wagon	25c
	14.	Toy Team. Horse, and House	75c
	15.	Home Workshop Bench.	15c
	15.	Inland Radio Cabinet	25c
	17	Crdur and Mahogazy Chest	25c
	18.	Telephone Table and Stool	254
	19.	Grandfather a Clock	25c
	20	Flat Top Desk	75c
	21	Cuton al Writing Deak	75c
	22	Girl's Cobinet and Deals	75c
	23	Pergula Garage	35c
	24	Goteleg Tuble	25c
	25	Saging On fit for Campe	15c
	20.	Buby a Crib and Play Pen	750
	3	K cehen Cubinet Work Table	25c
	38	Puliman Play Table	25c
	20	Tuy Ten Cart Garage etc	25c
	10.	Tool Cabinet Beach Hook etc.	35e
	23	Prescribe Sewing Cabineta	75c
	72	Chinese Game Toble	23E
	33	Pullman Dining Alcore	25e
	34.	Trethnes for House and Garden.	25c
1	of Philo		
		(Please print)	



A feellow is apt to forget the time when he's getting a lot of fun out of good tools. For instance, a Simonds Saw sings its way across a board with so little effort. There are many reasons why, mostly due to Simonds over ninety years' experience making tempered steel cutting edges. Ask your dealer about SIMONDS Hand Saws, Hack Saws, Files, Circular and Cross-Cut Saws





#### U.S. Government Needs Men!

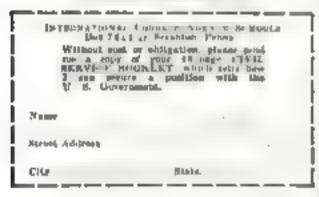
WONDERFUL, opportunities in Civil Werver Thousands of appointments made yearly Generous salar es, there yearlessed (as made as 16 days with pay in some 'ranches of the service), processors, sick way benefits, short hours (from 9 to 4.30 in Washington), congenial working conditions

Men and women are needed right along as Income Tax Auditors. Bookseep re-Fost Office Clerks and Carriers, Customs Cashlers, Hastway Postal I crack Deps y Cole fors, Postmasters, Gaugers Strong raphers etc. Postmons are op a a Washington and In every city of the robotry as well as in Anaka Post-Rico. Hawaii, and the Post patien. Over 19.000 pripoint enter with the poster.

"Pull" and influence unnecessary. Common achool education is sufficient as groundwork for most positions.

Examinations are easy to pass if you have proper couching. Right at home in spare time through the international Correspondence Scoods you as mare to not or y pass your examination, but to pass with a high mark. The higher your rating the more certain you are of an appointment. Thousands of part and women now imployed by Unite Sam prepared for their positions through 1. C. B. training

Mail coupon to-day for de-page FRESS 11411, SERVICE BOOKLET



AGENTS

Make \$10 to \$20 daily salling Premier Knife and Salazara Sharponers.

or more, 9 out of 10
warmen buy Produces been edge
quickly Salls for 50c
PREMIER MPG. CO.
Dupt. 9 Detroit, Mich



HOW ONLY \$35

the tide HB One Day Battery larging out it in your shop complete with beach, but have connectors rables, etc. Easy perms on balance. The forest private complete autifit in the market. Start naw to make \$1.500 to \$5000 yearly charging batteries. Send for free Bullerin 94

HOBART BROS, CA.

#### How to Keep Your Automobile Polished

(Continued from page 76)

is to use a sponge, which alternately is dipped and squeezed over the surface. It is permissible to use the force of the bose under the mudguards.

Clean chamois should be used immediately to dry the varnish.

Good polish of various grades is obtainable ready prepared. A polish containing grated becawax or cedar oil is desirable, and paste wax polish, which comes in small tins, is excellent. The writer has a preference for a simple paraffin polish, which is made by dissolving shavings of household paraffin for several days in the smallest possible quantity of clear turpentine.

By the use of these wax or parafile polishes, the surface of the varnish is covered by a glasslike coating. This will respond with a bright luster when rubbed with the cheesecoth, and it will shed rain

FOR winter use, when the owner is not concerned as much about the gloss as he is about preserving the finish, a protective polish made of two parts of bolled lineeed oil and one part of turpenting will be found even more protective than wax polish. If desired, varnish can be added to the turpentine, using one part in five. A polish so made is applied with a cheme-cloth pad. Monthly applications of these oil polishes will result in excellent preservation of the Varnish throughout the winter. A clean turpentined cloth will remove the lineed-oil polish before returning to the more brilliant was polish In the apring.

For top preservation, the use of raw lineeed oil and turpentine, two parts to one, in excellent. Never use gasoline or kerosene on imitation leather top or upholstering, as it dissolves the coating. Use Castile soap and clear water to wash the top as well as the body

The upholstery also can be washed, if of leather or imitation leather, and can be polished with a cloth slightly dampened with the paraffin polish

Washing the car in sunlight or washing the engine hood while it is hot should be avoided, because the varnish is almost certain to become spotted.

To summarize the care of the finish as practised so successfully by Jackson:

1. Avoid direct sunshine if possible, by parking in the shade, and protect your car from rain and snow by running it into the garage or by application of oil and wax polishes to shed the water

2. Before using a cloth on varnish, remove grit and mud with a duster or by flushing off with water

 Use a good grade of wax polish over the varnish, and apply it only after the removal of all grit and dirt.

 Use only cleaning materials that are free of grit and keep all cloths and materials in a separate closet where they will remain clean.

When painting a floor in a room that is much used, I usually point a few pieces of burlap, old oilcloth or finaleum with the same color and use it to cover spots that get particularly hard wear,—O.M.A.



For that Jolly Beach Party

Pack your week-end bag, my goodbys to the bot, notey city and set out for a day or two of real fun and bealthy sport at the lake or sea. And don thought to take along your pocket orchestra so there'll be plenty of good muste for those who want to dence. If you want to be the hit of the party, he ready with a Hohner Harmonics—

#### The World's Best

There's nothing like good music for happiness and there's nothing like a Hohner for good music. Hohner Harmonicas are true in tone, accurate in pitch and perfect in workmanship. Get a Hohner Harmonica today and play it tonight. 50¢ up at all designs.

Ask for the Free Instruction Book. If your dealer is out of copies, write M. Hohner, Inc., Dept. 182 New York City.





# Elements of Industrial Chemistry By Allen Rogers

General Processes: Water, Its Uses and Purification: Fuels: Sulphuric Acid: Vitrio Acid; Elements and Inorganic Compounds: Ceramic Materials and Products: Pigments: Fertilizers, Bluminating Gas; Coal Tar and Its Distillanor Products; the Petroleum Industry; the Destructive Distillation of Wood, Or s. Fats and Waves, Lubricating Oils, Soap, Soap Powder and Giverne Essential Oils: Resids, Oleo Resids, Cum-Resuss and Gums Varnish, Sugar, Starch, Glucose, Destrin and Gluten Textiles: Dyestuffs and Their Applications; the Paper Industry; Explosives leather.

500 pp. Illus, Price \$3.00, postpaid

POPULAR SCIENCE MONTHLY 250 Fourth Avenue, New York, N. Y

## Keeping Photographic Developer at Correct Working Temperature

A MATEUR photographers who have their darkroom in the cellar often find the problem of keeping their developer in the neighborhood of 70 degrees a difficult one. Cellar temperatures range from 50 to 55 degrees in winter weather to 60 to 65 degrees in the summer.



Kleetric water booter keeps tray worth

In my own case the device illustrated solved this problem satisfactorily. It consists of a tin tank holding about 2 gain of water set in an asbeston - lined box. The top is

two thicknesses of tin with asbestos interining. The opening for the tray is just large enough to allow it to settle down in contact with the water.

Openings also are provided for a thermometer and an electric immersion heater.

—C. E. WEIBERREL, Syracuse, N. Y.

#### How to Install Automatic Light in a Clothes Closet

DARK clothes closets usually can be equipped with electric light at small cost. The best installation includes an automatic door switch, which turns on the light when the door is opened and turns it off when the door is closed

If the closet is on the second floor of a two-story house, the wires usually may be run in the attic. If on the first floor, the exciset way often is to bring the wires from underneath the floor

The material required is a sufficient amount of No. 14 rubber-revered wire to run from the lighting wires already

installed, a few percelain knobs or cleats to hold the wire from the wooden beams, about 10 it, of 7/32-in, circular loom to incase the wires where they come through planter and where they run on the surface of the wall down

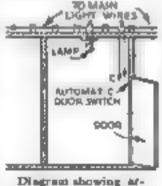


Diagram showing ar-

to the switch, a keyless receptacle for concealed work, with either an automatic door switch or a door-mounted hand switch. A small piece of solder and tape also are necessary

To conform to the requirements of the Board of Fire Underwriters, it is necessary that wherever the wires are tapped on to the main house line, the joints must be soldered and wrapped with rubber and friction tape. The wires must be supported from the framework or beams on porcelain knobs or cleats, and circular loom must be used, as indicated above.

If the wires are run under the house, BX cable or conduit must be used unless the distance from the floor to the ground is 5 ft, or more, in which case open knoh and tube work and rubber-covered wire will do.—C. P ANDREW, Charlotte, N. C.



That millions of people want, and know they want, is sure to be forthcoming! This new Magnavox certainly proves it. Handsome enough in its dark blue and gold finish for the finest mansion—snordy enough to stand rough usage at camp—cheap enough for the most modest salary.

Above all—so clear and mellow in tone, so true in pitch, that even your critical musical friends will be convinced that the "Radio art" has arrived. M4 requires no battery—a definite evidence of achievement.

At all good dealers

### THE MAGNAVOX CO., OAKLAND, CALIF.

New York Office: 350 WEST 31st STREET

Canadian Distributors - Perkins Electric Limited, Toronto, Montreal, Winnipeg





## Ward's Radio Catalogue

MONTGOMERY WATER

#### A Valuable 68-Page Reference Book on Radio—a Market Place for the Best in Sets and Parts

We want you to have a copy of Ward's new Radio Catalogue. You will find it to be an encyclopedia of information on Radio, the livest topic of the day. It contains a new Radio map—diagrams of the best hook-ups—descriptions of complete sets, and standard parts for building sets.

Headquarters for Radio

Montgomery Ward offers you all types

of Radio Equipment at a naving. We sell direct to you only merchandise of high est quality. Everything you buy from us, carnesour 52 year-old guarantee—" Your money back if you are not satisfied."

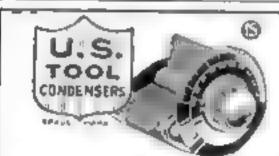
#### Enjoy the Long Winter Evenings

Every form of entertainment can be brought into your home by Radio. Keep in touch with the world—Sports—Election Returns—Dance Munic—Speeches—Sermons—Current Events—you can enjoy them all by Radio.

Write today for your copy of this complete Radio Catalogue. Address our house nearest you Dept. 5-R.

## Montgomery Ward & Co

The Oldest Mail Order House is Today the Most Progressive Chicago Kanssa City St. Paul Portland, Ore. Oakland, Cal. Pt. Worth



## Innovations that set NEW Standards of Condenser Efficiency

THE efforts constantly directed to keep U. S. Tool Condensors a leader have resulted in these remarkable new features.

One Piece Stator, Hezagon Shaft eliminating faunting of rotor blades, Three Mounting Lugs and Pigtal Connection.

Guaranteed 3%, plus or minus, from indicated capacity

Ask your dealer to show you these new types: Nos. 5 and 6, with relevon end places. Nos. 5 and 6, with

low loss metal end plates.

100% GUARANTEED
Write for Literature

U. S. TOOL CO., Inc. 127 Mechanic St., Newark, N. J. Mire, of special ands, do. gt. unbounte mechanics and interested



#### this is some tool

YOU can take your choice—one model No. 11 has three screwlinger blases the other No. 12 has a keen stee kn e blade and two screwdinger leader. Both modest work just the same, and with both of them you can CHANGE BLADES INSTANT(A)

At blades are selected and produced by gravity action, the blades can never be lost, the hade blade can never fold or turn and in ure you. Beautifully made, an uno tally handy tool for a thousand uses. Handles blade to propose that

Model No 11 for \$1.80, and No. 12 tor \$2.25. Send money order or your check and we will ship post prepaid at once. Each tool guaranteed. Your money retunded if not satisfied.

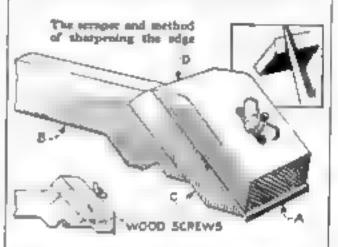
Dearer was requested in overer for enformation on these tools and the Summer Automotic Ten Square

THE SIMON & SKIDMORE MFG. CO. Dapt. 5-8 Sents Ann. Collings

#### How to Make a General Utility Scraper for Woodwork

A GOOD scraper is an indispensable tool in the home workshop. It is useful for smoothing hardwood floors preparatory to sanding and finishing, even though a weighted, wheel-mounted scraper or motor-driven sanding machine has been used first. It is of value in surfacing and smoothing all kinds of new woodwork, for cleaning old floors that are to be refinished, for removing rust and scale from metal, and for taking off old paint, varnish, or putty from wooden surfaces.

When a commercial scraper holder is not available, a substitute may be made as shown. Use a piece of seasoned beech, maple, or other hard wood about I is in, thick and 15 in, long for the handle, B. Gut the end at an angle of 45 degrees to take the tool neat, C, which should be of hard wood 8 in, long, measured with the



grain, 414 in. wide, and at least 50 in.

Bevel the lower edge and round the upper edge. With a rabbet plans or a sharp closel, cut a recess across the face of this piece, slightly less in depth than the thickness of the scraper blade, A Attach it to the handle with finthead screws. The clamp, D, is 34 by 2 by 4 lain, hard wood cut with the grain running up and down, at right angles to that of C, A bolt with thumb-nut hold this against the tool seat, clamping the blade,

The blade may be a cabinet scraper, a pleas of steel out from an old saw blade. or similar hard, well-tempered steel. Two opposite edges are filed or ground to an angle of about 45 degrees and, for fine work, rubbed on an ollstone to a chisellike sharpness. Then clamp the blade in a vise and draw across it from and to end a burnisher, buil-set, or other hard tempered tool. Use considerable pressure and gradually turn the edge over. A little experimenting will show the amount of burn that will take off a fine, clean shaving from a wooden surface. If the burr is turned over too far by accident, it can be raised by running along it the point of a burnisher or penknife.

To use the scraper, apply pressure against D with one hand and with the other hand draw the handle toward you, with long, regular strokes. Keep the handle parallel with the surface of the work

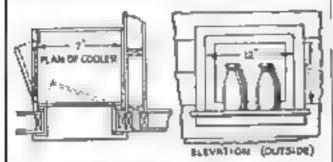
When one edge of the cutter becomes dail, the binds may be reversed. Burnish the edge frequently and resharpen it at intervals, as necessary.—Howard E. Good, Waterville, Ohlo.

#### Outside Service Door Improves a "California Cooler"

By A. May Holaday

IT IS difficult to estimate the number of steps saved every week by the use of a small service door set into the "cooler," as the ventilated supposed so common in California is called, or, indeed, any kitchen supposed that is built against an outside wall.

At a convenient height for the milkman, an opening is cut through the wall and cased all around like a window. A small



Milk bottles placed on doorell are taken in by reaching through rooter from itsade

12 by 12 in, door is hinged to open inward between two shelves of the supboard, and is fitted with a supboard catch

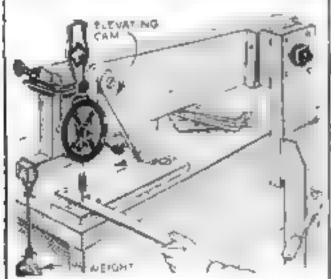
By reaching through the innde door from the kitchen, one can place empty bottles through the outside door-opening onto the flat sill, where the milkman replaces them with full bottles.

Thus, instead of taking many steps across kitchen and back porch, the housewife merely opens her supboard door, and draws the full bettles of milk inside to the cool supboard.

#### Small Drill Press Quickly Made for Emergency Use

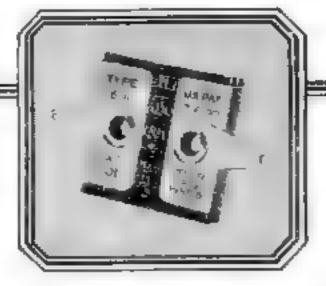
IN AN emergency, when several hundred holes have to be drilled in sheetbrass parts, a drill press was quickly made from material on hand in my home workshop.

A 1 1/-in. plank, 8 in. wide and 2 ft. long, was pivoted by means of a bolt and



Hand drill clamped to pivoted plack provides means for doing light drilling speedily

wooden spacers to a shorter plank and the latter was gripped in the beach vise. A hand drill then was fastened to the free end of the longer plank with a C-clamp. An arm of thin wood pivoted as indicated to the long plank, served to esevate the drill, and a weight provided the necessary pressure for drilling.



## **MICADONS**

-condensers of fixed and permanent capacity

You will have condensers that maintain their fixed capacity if you buy Micadons.

These accurate Dubiller Micadone are found in over ninety per cent of the sets made by amateure and manufacturers throughout the country—The experts specify Micadons.

The name Dubiller on a condenser has the same meaning as the pame Sterling on allverware—quality.

There is a Micadon for every circuit—different types are made for different requirements.

For free backlet showing method of soldering billoadons in todio circuits, address, if West teh Street, New York

# Dubilier

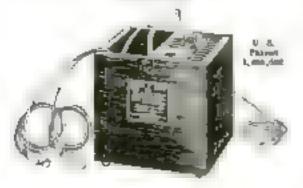
CONDENSER AND RADIO CORPORATION







Tested and Listed as Standard by Underweiters' Laboratories



## A noiseless bulbless radio battery charger

Entering the field late last year, the Bathire Battery Charges is paday universally accepted as one of the most efficient and trouble free methods of charging radio batteries.

1. This charger is entirely noiseless. It cannot deteriorate through use or disuse. 3. It has no moving parts or bulbs. 4. It has nothing to adjust, break or get out of order. 5. It cannot discharge or short-circuit the battery. 6. It requires no attention other than an occasional filling with distilled water. 7. It delivers a taper charge, and cannot damage the battery by overcharging, 8, It cannot fall to operate when connected to the battery and line current, 9, It is unaffected by temperature or fluctuations in line current, 10, it is simple, efficient and indestructible except through abuse 11. Without added attachments the charger may also be used to charge "B" storage batteries. 12. It can be used while the set is in operation without disturbing sounds.

The Fautreet Builder Battery Charges will charge the artimary 6 volt radio at animously storage battery at 3 amperes, from 110-120 AC, 50-50 syste current.

Manufactured by
Fanateel Products Company, Inc.
North Chicago, Illinois

Price \$19.50

B

West of Rockies \$20 In Canada \$27.30

At your dealer's. If your dealer cannot supply you, sent prepaid on receipt of prior

Balkite Baltery Charger

# The Shipshape Home

Electric Fixtures My noun workshop is the major factor in helping to keep my home shipshape.

It is the accumulation of years of doing odd jobs and making things for myself When anything needs doing around the

house, I do it myself. If I need some tool, I buy it with the money that will be saved, and when I have the job finished, I have the tool left as profit. By buying tools as they are needed, it is easy to own a fine outfit

The biggest help to me in keeping the home shipshape is reading Populan Science Montelly. It is a regular mine of ideas, aids, and suggestions on how to do aimost anything. Priend Wife reads it, too, and evidently with results, for I came home one day and found her calculy screwing back the top of the electric from. A connection had come loose and she had

taken it apart, repaired it, and put it together again. It works fine.

Now I want to pass along to you a

couple of ideas that have saved me money All the electric fixtures in the house were old when we moved in. They were

were old when we moved in. They were in good electrical condition, but the outside was spotted and discolored and looked like bad news. A can of flat black paint made them look like the latest thing in

wrought iron. The effect was so good that I made some shades from sheet metal and parchment and painted the metal part black to match the fixtures. The picture gives an idea of the effect.

The other idea was to use a broken automobile windshield glass as a shelf for the bathroom. The glass was about 8 in. wide and 80 in long, with one jagged end where it had broken. I trimmed off this ragged edge, made three wooden brackets, one for each end and one for the middle, and had a cheap pate-glass shelf. S.B.



Flat black point transforms shabby fixtures

You can save money in repairs by taking proper care of your door and window screens. How to do it will be told next month.

Kitchen Improvements

121 11 1 11

come be

Sometimes a kitchen sink is placed in a corner in such a way that no

drainboard can be provided without changing the plumbing. This was the case in my own home.

I overcame the difficulty by constructing a slightly slanting drainboard so shown, 12 in, wide and 4 ft. long, with

one end cut away so that no part of the ensk would be covered A DOZZOW strip in front leeps the dishes from slipping to the floor, and strip at the reat forms a splash-

board to protect the wall from spots. The joints were made waterproof by running a piece of tape saturated with white lead where the edges come together. The board was fluted or grooved to improve the drainage. The legs were attached with small angle trong. The whole was finished with several costs of raw lineed oil.

Brushes, cleaners, and soap are kept in a box under the sink. This is a cannedgoods box, smoothed with plane and sandpaper on the top edges, and covered on the two exposed sides with a scrap of linoleum left over from the floor. The next appearance is dependent upon the care taken to match the pattern of the linoleum where the side and end pieces meet.— Austrix G. Tribute.

> Patching Concrete

Occasionally it is necessary to repair damaged or cracked concrets work. This

is difficult to do successfully unless the following suggestions are observed:

Use the same proportions of sand, gravel, and cornent as were used in the original mixture, so that the new work will expand and contract the same as the old concrete. Otherwise the patch will crack

Keep the place to be patched thoroughly wet for several hours before working on it. There are be done by covering the surface with old sacks well esturated with water. For this reason a rainy spell is a good time to patch concrete, although the work should not be done while the rain is falling on it.

The place where the patch is to be made should be roughened with a banamer or

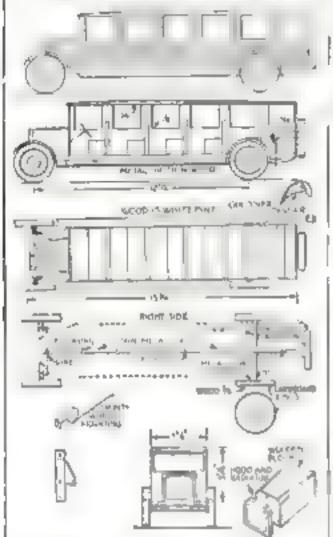
chuel if it is smooth

After the patch has been applied, the new concrete should be kept most and allowed to dry very stowly. This can be managed by covering the concrete with wet sacks, burlap, or rags, or by using most sand.—M. W. Lowsy, Athens, Ga.

#### Sturdy Toy Motorbus Has Unique Steering Device By Donald W. Clark

"HIS toy motorbus, which is made mainly of wood, can be built with little difficulty and practically no expense. It has no motor to compacate the construction. The child pushes it around from behind, steering it as he pleases by turning the spare tire, which is ingeniously connected with the front axle.

The accompanying illustrations make clear the construction of the various parts.



Made of this wood and painted brightly this is a toy that will delight little total

The body is built up of thin wood and the wheels are wooden disks with a cardboard circle glued to each to represent the tire.

Tin covers and strips of tin serve as the fenders and runningboards, and heavy tin or sheet metal is used as shown for mounting the front wheels. The front wheels are connected by a wire bent so that the point in the cepter projects downward and engages a glot in the first of the two thin metal strips, which serve as steering rods. These strips are pivoted as indicated and are moved by an L-shaped piece of 1-16-in, wire fixed to the center of the spare wheel in the rear. Turning this wheel moves the front axle to the right or left, an desired

#### Coming Workshop Articles

TOW to Make Unique Craftwork Dinner Googs. Imitating Inlays by Stenciling Wood-

work with Sunlight How to Store and Care for Your Window Screens.

Constructing a Filing Attachment How to Keep Your Dilstons in Good Condition.

Photographic Vignetting Masks Made with Films.

Stant Black It will look just as good as new!

"HIS old kitchen table needs a lot of fixing—but after the Sargent Auto-Set Bench Plane smooths the dented top and trims the battered edges, the job will be nearly completed.

The Auto-Set certainly does fit in at a busy work-bench. It's so capable, keen-cutting, and easy to adjust and handle. It will last for years and years. The special chromium steel cutter is as keen as they come and holds its edge much longer than most. But when it does need sharpening, only a few minutes are required to remove, whet and replace it.

50 Water Street

You don't have to touch the original adjustments.

For the smaller jobs, for the finishing touches to cabinet work, or for getting into close quarters. you'll need the Sargent Steel Block Plane. Thus is small in size, but big in ability. The low angle arrangement of cutter makes it particularly suitable for cross-grain work and rough or knotty surfaces.

Both of these Sargent Planes are used everywhere by carpenters who take pride in the character of their tools. Write for Plane Booklet.

#### SARGENT & COMPANY

Hardware Manufacturers

New Haven, Conn.









## BUILDING TRADES' HANDBOOK

409 payee. 263 illustrations.

Only

A reference book for every man connected with the building trades. Contenta :-

Blue Prints, Weights and Monaures, Formulm, Managration,

Geometric Drawing, Structural Design, Materials of Masonry Construction (stone, brick, terra cotta, lime, coments, sand, morter, con-crete), Carpentry and Joinery, Roof-Ing. Steel Square, Plumbing, Heating, Estimating, Architectural Denigo, etc.

Thousands sold. Complete-practical—thorough. Easy to understand. Porket size.

Just fill out the coupon belowslip it into an envelope with a dellar hill and mail, and this 409-page I. C. S. Building Trades' Handbook will come apreding to you by return mul.

You run no rick Money back if desired

International Correspondence Schools Box 7012-D, Seranton, Penna.

I spelme One Dellar Photos send me-tent per to be the page I to R Mai ting Traffer Hamiltonk at a tankentonia Phas I am not on toly sended I may setten this back with a five days and year win refutes my benedic

Name who were not not not at

Address



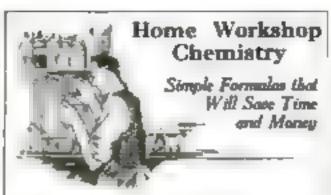


#### Tool Cases

for Machinests, Carpenters and Tool Makers none better, thoray styles, Quarter ed sak and meta cov-

"Built for Service"

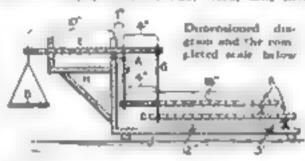
The Pillied Lamber Co., Security, Ohja



CCURATE scales are expensive to buy and quite difficult to make by the ordinary method. A delicate balance is secential, nevertheless, as soon as really careful chemical work is to be done in the home workshop. The question is, how to make a dependable scale cheaply and without taking a great deal of time.

My best suggestion in answer to this question is the construction illustrated below. I am sure that the many readers who have shown their interest in the Home Workshop Chemistry series by writing to me about this and other questions will find such a scale simple to make and adequate for all ordinary requirements. It will weigh light as well as beavy objects.

The scale can be made from metal or wood strips, thus boards, wire, tin, and





three safety-ranor blades or old knives. It should be made accurately, for a slight error will throw the entire balance out of order

The dimensions are in inches. If a smaller scale is desired, each inch can be divided into halven, taking a half inch as the unit of measurement. The scale should not be made smaller than half size

The scale shown consists of a base 22 to. long and an upright about 10 in, high, The base and upright must be firm

The top of the upright carries a range blade, A, firmly fastened in position, edge upward. On this is placed a wooden rod, E, that is 16 in. long and about 1/4 in square. A tin U or V is fastened to the rod by in. from the end to carry the weight pan and 10 in, from this point another V of tin is fastened, this time on the under side. This V rests on the knife A. One inch from this point another V is isstened on top of the rod, while 4 in. from this last point another and final V is attached. These V's are bent from tin and nailed to the long beam.

The baseboard has a razor blade placed 20 in, from a line drawn vertically through the knife of the upright. This

109)



Layer Wound and Layer Insulated-Powerful Magneta

These are distinctive features of

## Stromberg Carlson

Loyer winding means that the code me tround in layers of sure with insulating ma-

tround in layers of wire with insulating ma-terial between each layer. This chairing growt resistance combining the stateuments to stand up under the highest plate vol ages. "Powerful Magnets" erfers to the great strength of the magnets used to our instru-ments. Strong congnets are necessary to bring to the long distance agends with their full volume and clearness. Stromberg Carlson reception apparatus have suggets that are exceptional for permanent strength.



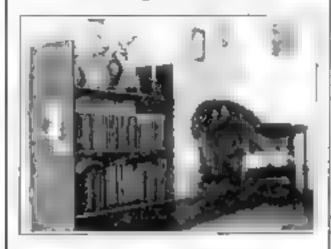


with Each World Storage Battery
proved anti-factory World surject-each. Hall this pd over
per name part after one to writinity for the little pd over
per transport and proved provided by the little pd over
per transport of the factor provided post of the little post of the littl

FREE



#### Old Table Leaves Utilized in Building a Bookcase



HAVING a number of old table leaves, we sawed off the little knobs, poured wax in the depressions and used the pieces to build book shelves as shows. They were enameled black and decorated with bright flowers. These were painted on the black surface in such a way that they bude concealed the wax depressions where the knobs on the edge had been removed.—M L. Cherry, Sandusky, Ohio.

#### Home Workshop Chemistry

(Continued from page 108)

blade supports a tin V placed 1 in, from the lower and of the bridge, D, which is a board 17 in, long. Exactly 15 in, from this point another V is placed on the under side of the arm and it is connected with

the beam by a wire arm, G

The upper bridge arm or weighing platform, C, is a board 19 in, long. It is bolanced by a knife firmly featened to bridge D exactly 3 in, from the end knife, on at K. A V is used here as in the former cases, and another V is featened to the weighing platform, 16 in, away. This V is connected by means of wire P to the V on arm E

The scale pan, B, is fastened to beam E by means of the V at its far end.

The support, H, prevents the beam from swinging too much and indicates when the scale and the pan are balanced. The swing should be very small, not more than 14 or 14 in.

The length of the two wire arms P and G are determined by the height of the upright and the height of the knives. The arms E, D, and C must be perfectly horisontal or the scale will not work properly

To balance out the scale, add slight weights to sither scale pan B or bridge D, so that beam E is in equilibrium. Then if I gram is placed in B, 10 grams will be bulanced at C. This means that a weight placed at B will balance another weight at C, which is just 10 times as heavy. By reversing the process and placing the weight on C and the object to be weighed at B, the object will be exactly one-tenth the amount.

The decimal arrangement gives a flexfullity to the scale that is desirable in the home laboratory. The necessary weights can be purchased from any scientific druggist supply bouse. Your own druggist usually will be glad to get them for you.

PUTTY may be kept soft by covering it with water. To prevent the water from evaporating, add a few drops of lubricating oil. This will form a surface film.





# TWENTIETH CENTURY Book of Recipes, Formulas and Processes

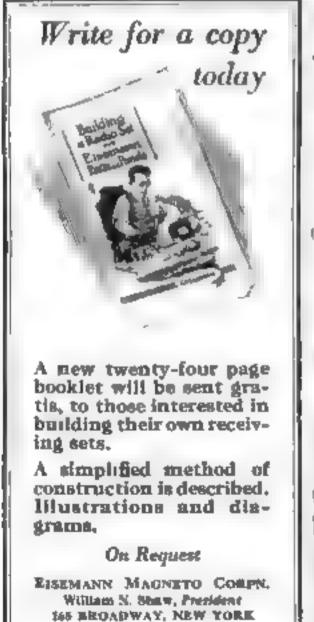
This book of 800 pages is the same complete Book of Recipes every published. Here Helps, Practical Ideas and Secret Processes covering every branch of the unful arts are given.

A mine of information, up-todate in every respect. Lonturns an innocure number of formulas that every one sught to have that are not (ound in any other work.

Price, \$4.00

Popular Science Monthly, 256 Fourth Ave., New York





Provide River



onfortation to wear no decay from wick Awarded Gold Medal at Rome and Grand Prix at Paris.

Send No Messay, We will send you a trial of Places shoulder, while will send you a trial of Places shoulder, while twill now or later. Writer for it makey, also had believes then.

PLAPAG LABORATORIES, 19ock 716 St. Louis, Mr.

#### How to Aline Auto Engine Connecting Rods

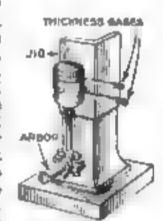
By Ray F. Kuns

Principal, Automotive Trades School, Cincinnati, Ohio

MOTORIST brought his car into the shop not long ago and complained about the noise made by the valve lifters. He asked that the engine be gone over. One very bad vaive lifter with a flat roller was removed, the hearings were taken up, and other work done. The owner then left for a trip covering saveral states.

When he returned he said that the cur had run nicely, but that there was enother had lifter none

"The first 200 miles I drove as you told me, at not more than 25 miles on hour," he explained. "After that, speeded up a little and then I noticed that the old lifter nosse was back. It. doesn't seem to do any harm, but I do not like the noise. I want to leave the car and have you put in another new Liter."



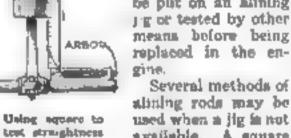
Checking alonement on special Jig.

A mechanic found that the lifters were all right, although the owner could be oxcused for the mistake, since the noise was practically the same as the first one he had experienced.

The repairmen decided that it was a wristpin knock, and so it was, but not due to a loose pin. In doing the engine overhaul work the first time, the rod in No. 2 cylinder had been aprung out of line or the bearing improperly scraped. At any rate, the rod set at an angle rather than plumb, and when the explosion came, the upper and of the rod was unapped out against the piston boss, producing a knock. This is the sort of noise hard to find and galy one of the troubles likely to be experienced when piston rods are not properly almed.

Rods are thrown out of alinement when pistons are removed from the

cyalnders or other work is done on them They always should be put on an alining J'g or tested by other means before being replaced in the engine.



alining rods may be used when a jig is not available. A square net on the machined

top of the crankesse and along the skirt of the piston when the piston is on dead center will indicate the degree of misabnement. Another way is to clemp the rod hearing on an arbor and use the square to test the skirt.

A splendid method of testing the piston and rod assembly in relation to the cylinder is to assemble the job with the piston in the cylinder, but without the

(Continued on page 111)

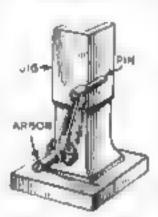
#### How to Aline Connecting Rods

(Continued from page 110)

rings. Have the cylinder head removed and hold an electric light under the cylinder to be inspected. If the rod is properly al ned, it will be possible to see a ring of light all the way around the paston in the cylinder. If the rod is misalized, the piston will be cocked in the cylinder and it will be impossible to see past it except at certain points where it is not binding.

When a rod is not properly alined it must be bent or aprung until it will allow the piston to fit the cylinder correctly Otherwise the cylinder will wear unevenly In bad cases it will be scored by the piston, and hearing trouble will develop at both ends of the rod. The piston pin is far more likely to be loosened from its anchorage, and piston pin scores result.

Merely bending the rod will not always sirre it and the piston. In some instances It is necessary to give the rod a slight offset by making two bends. A large monkey or adjustable wrench in the usual tool



Checking parallelism of red , nurnels

used for correcting rod trouble of this Determine which way and how much the job is out, and apply the wrench to spring the rod. After carefully alining and testing outside the engine cylinder, it is wise to make the lamp test as a final check

When Deraping rods, many mechan-

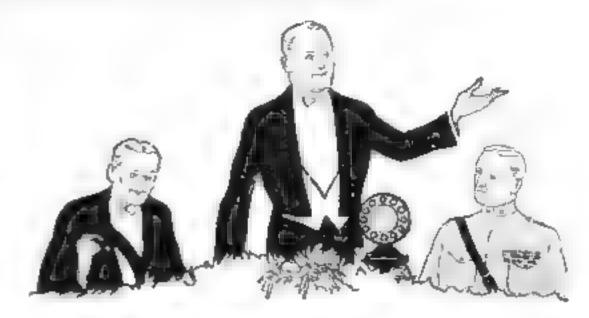
les prefer to get their final impression on the rod bearing by bluing it and rotating the shaft while the piston is in position in the cylinder. This frequently will show the workman that he has not scraped the bearing evenly and tell him just where to apply the acreper.

Another essential test in alining a rod is to see whether the axis of the pin and the shaft journal are in the same plane. If they are not, there will be a twisting and binding movement Imparted to the piston as it is moved up and down. The piston should be removed from the pin and the pin replaced in the rod.

By clamping the rod on an arbor, it is possible to sight the pin and arbor and get an approximate alinement. The best practice, however, is to use an alining jigthat has parallel surfaces that the pinmust atrike when the bearing end is clamped on the fixed arbor

Workman sometimes feel that because care has been used in disassembling and repassembling, things must be right. Factories long since have learned, however, that, no matter how carefully parts are machined and fitted, every possible test must be made for abnement. Just such methods as described and illustrated here are used to provide the quiet, efficient motors turned out in automobile factories.

"HE next article in Mr Eune' series I for the motorist who makes as many of his own repairs as possible will be on fitting new piston rings.



## Why thousands of radio fans enjoy him

Because thousands of storage batteries are on the job, brimful of energy, gaining clear, satisfying radio reception for every word and inflection.

With a Tungar, the carefree battery charger, in your home you can keep your battery tuned up to get every single note of music, every recitation, speech or song. Tungar charges the battery overnight from the house current.

Sold by Electrical, Auto-accessory and Radio dealers.



Tungar is one of the many scientific achievemente contributed by the G-R. Resentch Laboratories toward the wonderful development of electricity in America,

Tunger Better Charges 49-Prices, east of the Rockets the cycle Ourses - ampere complete, \$ 6 oo. 3 ampere complete \$16 oo. Special anachinens for charging 23 or 44 cell. B. Saringe Battery \$1 ms. Special marchinens for charging 3 or 4 vols. At charging 3 or a volt A" Storage Batters & 15. Both disastrates for either Tangan,



Transporter inglisters I treate mark-to found only on the general. Look for it on the name place.

Merchandise Department General Electric Company Budgeport, Connecticut

## GENERAL ELECTRIC

1500



At the low prices shows before you get the efficiency of ever owe at hire times as mostly. These ratio (requesity receivers you'd up that and over 1.500 miles away under ased coasts form.

Operate rither on DRY CR11.5 or straight business.

Cabliness of solid multiograpy and workmanaby, he finess throughout. Under direct or send for business.

Two rates outfit in shown above, headphones only has return outfit for the coasts.

1 ser suite outfit for fordepealur or basel (B. 1621-65) (B'elle for proper can good by his property of a property of the prop

THE MIDWEST RADIO COMPANY Cincinnati, Ohlo







#### Easy to Draw Cartoons

When Shows in the RIGHT WAY

Some of the deveront cartoculate and comic spileto tracted how to draw in their space once by following Cartocolet Evens Simple and Easy to Learn Marked and air now Mith. No CODD MANEY Send one of four disprince, and in Mr. Evens see it you be a military that from a the Postfallo of Cartocole and tuit dyname about the course. It is not expensive.

THE W. L. EVANS SCHOOL OF CARTOONING 25 Labour Bestelling



# He Climbed . . . from \$60 a month to \$10,000 a year

Ten thousand a year! That is what a North Carorina man is averaging—even in dull years—as partner in an independent firm of Certified Public Accountants. Yet six years ago, when he started the study of higher Accountancy under the LaSalic Problem Method, he was earning only \$60 a month, was married and had also a little

daughter to provide for,

Luts of men would have thought they were hopelessly up against it. But this man was made of different stuff—there was nothing of the quitter about him/ He actepted LaSade's offer of easy terms, and started to study Higher Accountancy at home in his spare time. Today, he has the great satisfaction of knowing that he has made good. He is able to five the way he wants to live—to give his family the comforts and luxuries he has always longed to provide for them. He has proved his right and title to success.

#### His Chance Is Yours

The experience of this man (name furpished on request) is not an isolated example. Hundreds of men have won rapid
advancement thru Labarle Higher Accountancy training. They got their start by signing too such a little coupons as appears directly below
this text black that coupons as appears directly below
this text black that one on sign and man it today—
and set the fact. We as proporting one for one
ten ned in if they Accountancy also a complete plete niormal enegated ag the apporting one for the
ten ned in if they Accountancy also a complete plete leads and a protected from the "Get
Pue leads and a protected from the "Get
get from Fyou have to pay five desire leafs in training
in an all and can be covered in easy broughty payments of you so desire. The decirion that you make
the moment is important. Man the coupon were.

#### LaSalle Extension University

The Largest Business Training Institution in the World Dept. PS3-HR Chinage, III. Please send me your book, "Accountainry the Pt new alor That Pays, and full internal on regard ag the contrar and movee. Alor

informs on regard ag the totams and service, Also a copy of tour book.

The Years' Promotion in One." All without obligation to me.



#### Higher Accountancy

Training for position as Comptroller, Auditor, Certified Public Accountant, Cost Accountant, etc.

Other LeSalle Training Course

LaSalle a the largest business training estitution in the world. It offers training for every important business need. If m to interested in any of these courses, check here.

Official person Mediagations of the Mediagation of

Management
Claw Degrate of LL-R,
Offonmercia: Law
Cludestrial Management
Exteriory

Modern Business Correspondence and Practice DRanking and Pinesse Disolern Foremenship and Production Methods Dransmal and Employ

O Ferousel and Employment Matagement O Espert Sockhooping O Sestume English O Commercial Spenish O Effective Speaking

DC. P. A. Creeting

Mame

Present Position.

#### Address ----

#### Homemade Metal Tray Alds in Sorting Screws Quickly

IN LOOKING for odd size acrews or other small parts in a miscellaneous amortment, much time often is lost in returning the collection to its container, and frequently shavings and dust are swept from the bench top into the container along with the acrews. These



Replacing screws in

difficulties are overcome by using a pan of the shape shown. Screws may be spread on it and when those of the right eine have been found, the remainder can be poured back

into the container with one rapid motion,-C. E. WEIBERAHL, Syracuse, N. Y

#### How to Construct a Jointer

(Continued from page 80)

chase a knife such as that shown in detail D at a low price, so that it would hardly pay to take chances of losing a homeronde knife while tempering. If the safety head is used, the knife blades will come as part of the head.

The four holes drilled through the bottom members and marked F are used for fastening the machine to the beach. A hole shout 6 in, square is made in the top of the beach to allow the shavings to drop to the floor.

The motor may be located beneath the bench and the belt brought up through another hole large enough for it to pass. While I have not shown a loose pulley on the countershaft, it would be an easy matter to put one on and, as the driving pulley for the head is on the outside of the side members, a belt shifter could be attached directly to the bottom member to which the countershaft bearings are

The 2 by 1% in, flanged pulley should be keyed to the shaft, as it would be impossible to get more than one setscrew in the pulley. The key need not be larger than 3/15 in, square, but should be well fitted and driven home snugly. The same is true with reference to the countershaft pulleys. Care should be taken to see that the pulleys are true and well balanced.

One point in regard to the wedges used for tarring and lowering the table should not be everlooked. They should be made so that the grain of the wood runs with the wedge edge. This will prevent rough edges from rubbing together. The surface should be well greased.

Hefore starting the machine, see that it is thoroughly oiled. Use an endless belt, as a laced one running at this speed will cause a great deal of vibration and in time tend to loosen parts of the machine. It is very important to bear in mind that the table and cutter head must be true with each other in order to do perfect work

If reasonable care is taken in purchasing the materials, one should be able to build this jointer. I estimate, for about \$30 and have a machine that with care should last a lifetime



## A Vertical "B" Battery

Upright in Shape

Upright in Use

WHERE weight the rical regional Radio "B" Battones, buy the Burgess vertical "B" No. 5158

It is right at home an any position in your cabinet. Its stordy compactness is a result a necessity in portable receiving sets

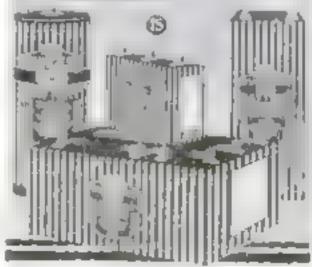
Its height, width and weight coincide exactly with the double strength Burgess Radio "A" Battery. You are rure to be pleased with both the convenience and service offered by such an assembly of A' and "B. Radio Batter ex

"ASK ANY RADIO ENGINEER"

## BURGESS

#### BURGESS BATTERY COMPANY

Engineers DRY SATTERIES - Manufact - re-FLASHEIGHT - RADIO - IUN'TION - ST EPHONE - rel Sa es Office Harris Tests Birds. Chiesan at also and Works Madison, Works in a Expense to a Mile and So by Name 2 allo that





## Clear Your!

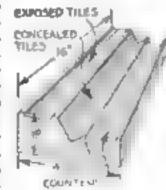
### Improved Combination Racks Aid in Playing Chinese Game By S. W. Blanchard

HAVING experimented with several different types of accessories for the now popular Chinese game, I evolved a design of rack that not only holds the conceased tiles, but also the exposed portion of the hand, as well as the counters. These combination races make unnecescary any other equipment and are preferable to those built into the edge of a special game table because they are portable. They also serve as straight adges in building the wall of the straight.

The racks are made as shown from any clear grained, soft wood. A combination plane is the best tool to use, but they

may be made with gouge, chisels, and an ordinary plane.

If you are near a CONCEALED. planing mill, you will find it occnomical to have the mill pick out some knives that will cut a molding to the design of this rack, or very close to it, and have sufficient molding machined to make neveral pets, each



Combination rade

of which will require 6 tineat ft. The molding, whether hand or machine made, is sawn up into 16-in, lengths.

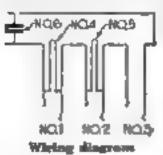
A pleasing finish is obtained by giving each rack two conts of black sheling, each lightly rubbed down with very find sandpaper and oil, and two more coats of plain shellac, also rubbed down. Red initials representing the winds are painted. on each rack in Chinese style.

Black shellar may be made by mixing dry powdered lamp- or bone-black with alcohol, being sure that there are no lumps, and then adding thick shelled to the mixture. There should be enough black in the mixture so that the shedge is perfectly opaque.

A good profit may be made by disposing of the racks to friends, or the sets may be used as gifts.

### Connecting Radio Jacks for Several Head Sets

BY USING radio jacks I have been able to connect instantly as many as four pairs of telephone head sets with my radio receiver. The method is shown in



the accompanying diagram. Numbern 1 and double - circuit jacks, of which there can be as many more as desired. Number 3, or the last jack, is a single-circuit.

Solder together the center springs of the double-circuit jacks, as at Nos. 4 and If the circuit calls for a telephone condenser, piace it shead of the jacks, as at No. 6. A double-circuit jack may be used at No. 8, but the center spring must be left open.—Theodore Engen.



### When you stop for the night

### Throw up an aerial and tune in just as if you were at home

MERE is no reason why you should deprive yourself of radio entertainment when you are away on a vacation. If your home set is too large and bulky, you can casily build a small vacation set you can carry anywhere.

The cost of your vacation set will be comparatively small. The battery of your car will furnish the necessary electrical current, and if you have a bome set you can take a hibe and the "B" betteries from that.

You should use the same care in selecting parts of your vacation set as you med when you built your home set. Buy dependable instruments and then mount them on a first-close pencl.

Use a Celoron panel and you help your instruments do their best work.

Caloron, a bakelite material, is one of the

finest insulating materiels known. It has high dielectric strength and great resistance

You can drill it, mw it, tap it, and bore it and it does not buckle, warp, or erack. It is practically industructible.

Celoron panels have been approved by the U.S. Navy and the U.S. Signal Corps, They are used by the best radio manufacturers and by thousands of radio fans.

You can buy Coloron Radio Panels in three beautiful finishes—black, oak, and mahogany. These do not lose their lustreor become discolored.

Practically all good dealers handle Celoron Radio Panela.

### Send for free booklet

If you will clip out the coupon below and mall it to us, we will send you an interesting booklet entitled, "Getting the Right Hookup with Celoron." This little book is full

of belpful suggestions forbuilding and operating a radio set. Send for your copy now. It

CELORC to atmospheric attacks. A BAKELITE PANEL is free.

Diamond State Fibre Company

Offices in Principal Cities

Beldgeport, Pa.

Torogeo, Canada-London, England

If you want to build a beautiful cabinet use Volcawood-the new cabinet material. If your dealer has not stocked Vulcawood, write us. We will send you a pamphlet telling you how to make a Vulcawood cabinet and will give you the address of the negreet. dealer, who sells Vuicewood.

Diamond State Fibre Co. Dept. R. Bridgeport. Ps. Please send me without charge a copy of the booklet. Getting the Pight Hook-up with Coloron." My radio dealer a mame is:

Address







### Wrestling Book FREE

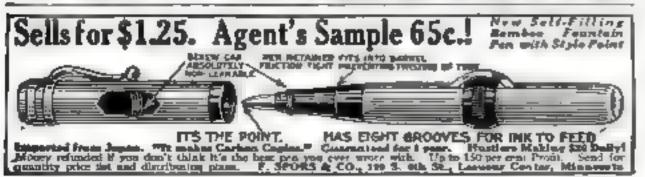


Frank Golch and Fermer i south and quickly harred at he CR HEACTER TO THE TOTAL PROPERTY OF THE PARTY OF THE PART









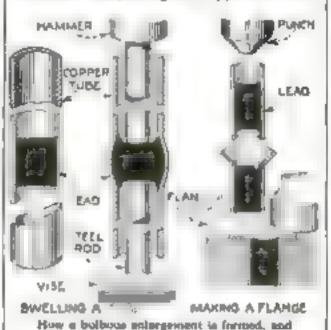
### Tricks that Aid in Shaping Brass and Copper Tubing

OPPER tubing can be shaped in various ways if one knows how to do it. Brass tubing -that is, drawn-brass tubing -can be handled in the same way, to some extent, but it will not stand as much stretching and bending as copper.

Before starting, anneal the tube thoroughly by heating it red hot and quenching in cold water. If there is much hammering or forming, anneal it at intervals

during the process.

A Job that looks difficult, but is not particularly so, is making a bulbous enlargement in a tube. Plug the tube with lead at the place where the enlargement is to be made, either by pouring in melted metal or by driving in a cylindrical plug, and then force the noft metal outward by pressure against the ends of the lead plug. The simplest way to apply pressure is to slip the tube over a steel rod held firmly in a vice, and insert a similar rod through the other and, using the upper red as a



a timple method of making a dange

punch. The lead is removed after the job is done by melting it out. This cannot be done where the tube in too long.

It is a good idea to fill a tube partly with melted lead or Babbitt metal when flanging an end, chiefly because it prevents the tube from becoming deformed just back of the flange. Leave enough of the tube free of lead to allow the flange to be turned over. In a piece of bruse or from drill a hole into which the tube will fit tightly, and see that the hole is square with the surface of the block. Start turning over the flange by belling out the end of the tube with a conteal punch, and then use a round-ended punch and the drilled block to carry the work along. Finally flatten down the flange on the block with the hammer

In the last stages of the work re-annealing will probably be necessary. While this will melt out the lead filling, it will not matter, because the tube will be supported by the block. Do not expect to be able to make a wide flange at the first attempt. A good idea is to spilt the dieblock so that when it is gripped in the vise the tube will be supped and held securely

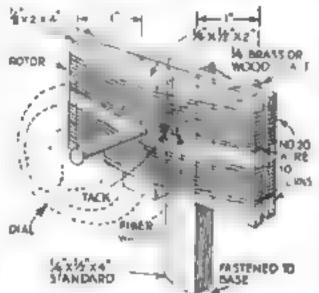
Bending can be done perfectly, no matter how complex the bends, if the tube in filled with melted lead: the tube will bend like a soft rod and will not flatten nor buckle.- H G.

### Unique Variometer with Flat Coils Allows Close Tuning

TWO thin boards serve as forms for the coils of the simple variometer illustrated, which can be made at practically no expense and yet gives exceptionally sharp tuning

A small block is glued across the rotary board, and the stationary board is fastened by means of another block to the baseboard of the receiving set behind the panel. A wooden or brass shaft \$14 in. long passes through both boards and in pinned with a nail or tack to the one that is to turn. A fiber washer separates the two bouzds.

Around each is wound 20 turns of No. 20, 22, or 24 mingle or double cotton-



One of the colle can be retated and siso moved away from the other coal

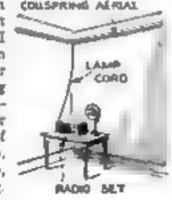
covered wire, I turns each side of the shaft. The coils are connected in senses with a flexible connector and a flexible lead is provided for the wire from the

The variometer is used as any other variometer, the knob being turned to the right or left to tune. For still sharper tuning, the knob is pulled out so that the colls are separated more than normally, the shalt having been made long enough to ! allow 1-in motion in and out

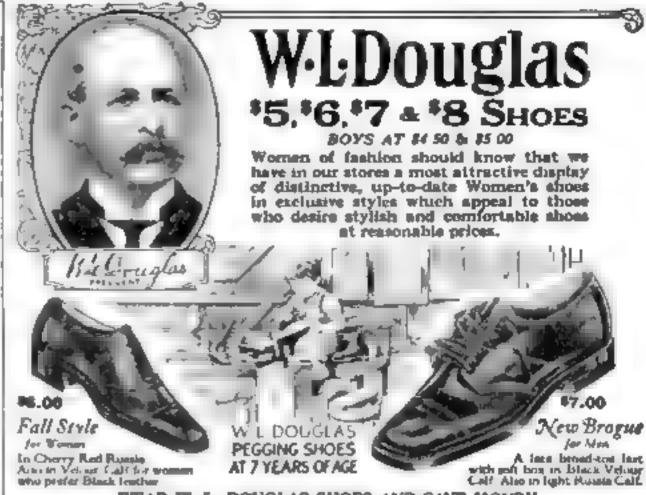
The same idea can be applied in the construction of a variocoupler and for various other uses in building experimental receiving sets, and various refinements can be made, such as providing a stop for the rotor, impregnating the wood with hot paraffin before winding the coils, and using hard rubber or fiber in place of wood.-JAMES GREENWOOD, Dunbar, Pa.

#### Collapring Serves as an Aerial

MOVING to BE COUSPRING ALFRAL apartment recently, I found I could not erect an outside aerual for my radio receiving set. I used, instend, an indoor aerial composed of two lengths of No. 22 hard bram wire, each 50 ft. long. WIFE The 77.24



wound into a spring 1/4 in. in diameter and strung from opposite corners of the room, as shown, being fastened to the molding with fiber books and insulators.- W. H. F.



#### WEAR W. L. DOUGLAS SHOES AND SAVE MONRY

FOR 38 YEARS, W. L. Douglas name and portrait have stood for quality, for economy and for setisfactory service W. L. Douglas shoes are exceptionally good values. Only by wearing them can you approxists their superior qualities. Such quality, comfort and service are rarely found in other makes at our prices.

THE EXCLUSIVE, smort models, designed especially for young men and women, are the leaders. Seldom have you had the opportunity to buy shoes of such wonderful value as you will find in the W. L. Douglas \$7.00 shoes in our retail stores in the principal cities, and in good shoe stores everywhere.

WHEREVER YOU LIVE, demand W. L. Douglas shoes. They are sold in 120 of our own. stores and by over \$ .000 shoe dealers. For economy and dependable value wear ahoes that have W. L. Douglas' name and the retail price stamped on the soles. The stamped price guarantees the value. If they are not for sale in your vicinity write for catalog.

W. L. Douglas Shoe Company, 134 Spark St., Brockton, Mass.

If no the WORLD PROGRESS with

Protest and Profit From Your Ideas

Sample copy free. One year's subscription edc. Send for free book,

"WHAT TO INVENT" containing Suggestions to Inventure so to Inventions Needed. We invite manufacturers to andress us regarding inventions they went

WORLD PROGRESS PUB. CO., No., Roses 301 Victor Brig. Washington, S.

# NOLES LEAK NO AIR

A new puncture-proof inner tube his been invented by a Mr M E M Iburn of Chicago. In actual test H was punctured 500 times without the loss of air-This wanderful new tube incresses mileage from 18 808 to 22 000 miles and alignments changing tirm, It copts no more than the ordinary tube. Mr Milharn wants them introduced everywhere and is making a special offer to agents. Write Sales Manager, J B Hanson, 336 West 47th St., Chicago



### Home Protection

Wently revery man warms a give in the same he fresh factor is a factor of the factor o him facilities

Committee Agency as appoint an expense of the following the second and the following the second and the following the second and the following the second se

\$7.75 In californ—7 shot—C. O. Q. Automatis, b. 85 25 calling—Y shot—Agus Automatic, c. 95 25 calling—Y shot—Agus with viple safety. 16 81 82 calling—10 shot Automatic, c. 22 calling—10 shot Automat

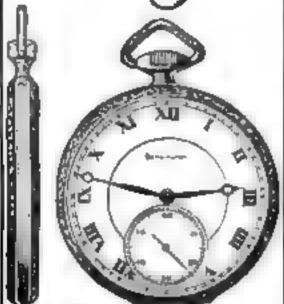
We ammented every pair against dejective work-banching grand new of Drop Formed Sept. Through-met. Sector buries any weapon INSON on this guarantee. S I N D N D N D N E V union you what. State model desired pay fourtage on delivery plus postage. Satisfaction guaranteed or money re-landed. Write for new Sectors talkings.

CALIFORNIA TRADUNG CO.

Terminal Ship., Seet. 75.

Las Angeles, Cal

# 21 Tewel Burlington



### LOOK!

Adjusted to the Second Adjusted to Temperature Adjusted to Isochronism. Adjusted to Positions 21 Ruby and Sapphire Jewels 25 Year Gold Strata Case Your choice of Diale New Ideas in Thin Cases

Only One Dollar Down will buy this masterpiece of watch manufacture. The balance you are allowed to pay in small, easy monthly payments. The Burlington — a 21-)ewel Watch — is sold to you at a price much lower than that of other high-grade watches. Besides, you have the selection of the finest thin model designs and latest styles in watch cases. Don't decay! Write for the FREE Watch Book and our Special Offer today.

# While this Special Offer Lasts

Oer the Burlington Watch Book by anding this coupon. Find our about this great special offer which is bring made for unity a lunized time. You will know a great deal more about watch buying when you read this book. You will be able to "mer clear of the over-priced watches which are no better. Remember the Burlington is sent to you for only One Dollar down below to be the property. belance to small monthly payments. Send the coupon for wetch book and out special offer Today! Do not delay one minuted

Burlington Watch Co., Dept. 13-66 19th St. and Marshall Blvd., Chicago, Illinois Canadian Address: 62 Albert St., Whitipag, Nov.

Please send me (without obligations and prepaid) your free book on wantes with full replanation of your \$1 down after on the Businesson. Wently,

Print name and address plainly

Name	 	 	 _

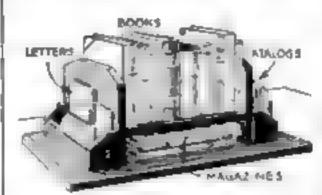
### Bookrack Has Compartments for Paper and Magazines

FOR a flat-top desk or a library table, the combination rack illustrated has the advantage that it holds not only books, but also magazines, note-paper and current correspondence.

The original was made of walnut to match other furniture, but any wood may be used. The materials required are as

1 pc. 16 by 10 by 12 ld in for the base 1 pc. 16 by h by 13 do for the shelf 2 pc. 16 by 8 by 10 ld in for the uprights 4 pc. 16 by 2 h by 4 h o for the pocket sides 2 pc. 16 by 2 h by 7 to for the pucket sides 2 pc. 16 by 2 h by 7 to for the pucket sides

To simplify the assembly, screws are used wherever possible. The shelf is



By changing the shape of the and pieces many veriations of this beokrack are possible

screwed to the two uprights, the screws being placed so close to the edge that the pocket ends will cover them, and the heads are countersunk. The uprights are screwed to the base. The pocket ends are nailed to the sides and the nails are set a triffe so that the holes may be filled with colored putty. The pockets than are fastened to the base and to the uprights

The design may be varied in many ways without changing the construction. The top of the uprights may be rounded or given as decorative a profile as the maker wishes, and then the upper edges of the pocket ends may be modified to harmoniss with them .- C. A. Rosma.

### Handle for Holding Camera

T IS difficult to hold hand cameras, superially those of small size, perfectly steady while a comparatively slow enapshot is being taken. By adding the handle illustrated, however, the photographer

MARKET LAND

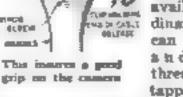
CHRES

Chia witters

The man

can get a good grip on the camera with one band only





in the center of the camera baseboard.

If a wire release is fitted to the shutter. the finger and of the release can be held in a small clip bent from brass sheet and held, as shown, between the camera and the handle.-C. A. OLDROYD.

### Are You the Type Who Must Fear

Old Age?

Byram C. Helly

Science now men out of ten must fear a serious condition that comas at middle age. Here is a situation that

you must face-a test that every man

abould make before it is too late.

I am past 40 myself. I had begun to wonder when I would begin to breakto lose my old-time pep and aggressive-ness—when, through a mutual friend I made the personal acquaintance of a certain member of the American Association for the Advancement of Science, whose wonderful work I had beard of I made a trip to his laboratories and the things I learned should interest every man approaching or past the prime of life. Surprising as it may seem, nearly two-thirds of all men past a certain middle age suffer with a disorder of the prostate gland.

#### Common Middle Age Ailments

Here is an important cause for many conditions which heretofore have been taken for granted as eld-age attorests —aclatics, school is back, legs and feet, frequent nightly risings, nervousness and irritable .y, and frequent disay spells, indicating high blood pressure. Constipation, headacher and depressed spirits often go along with it. But my visit would have been in vain had I not learned of to expected transport that relieves proutate troshis a treatment that reaches this gland directly and is so convenient that anyone can apply it in

#### 10,000 Men Find Relief

I know too plainly the effects of prostate gland disorder when it is allowed to continue unphated. I know of the operations and the common saying moong many that thouverage life after this operation is only two or three years. That is why I am dring everything possible to let people know of this important discovery. Stabingoon, backers, lawyers, doctors, men from every wask in life have used the method with success. I have read hundrade of letters from gratified maps. One bremember in particular was from a Colorado man which says, "Il years young to my age. Yet for years I suffered with prestate trouble. Used medicine to up avail -had about gives up hope when a doctor recom-mended your treatment." Just think of a man 77 years old restored to the health and busyancy of youth - without drugs, sleetric rays or books.

### All Explained in Free Book

If you have prestate trouble, if you suffer with may of the allowants mentioned above, you should not lose a day in finding out about this wonderful. new method. Send immediately for an interesting. Iree book exiled, "Why Many Men Are Old at the It describes this splendid treatment and shows you how you may regain much of your yeathful circs. Send your request to the Electra-Thermal Company 0000 Main Street, Sleuben ville, Ohio, the concern that is distributing these broks for the nuther. There is no observation. If you are not interpreted programs you may be able to do an "older" friend on immensorable benedit by showhas him this article. Mail the coupers.

#### The Electro Thormal Company. 4037 Main Street, Steubenville, Ohio

Please send me, free without obligation, the booklet, "Why Many Men Are Old at 40."

Name				1 440
City			State.	* 1 7 4 1 1
Address	n.	La.		10 1011 10

Western Differs Dept. 40-h, Los Angeles, Callinguis.

### Built-In Ironing-Board Has Strength and Simplicity

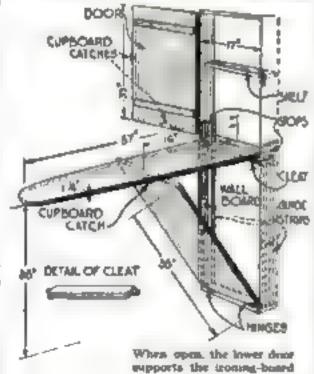
THE folding fronting-board and cupboard illustrated is of very solid and simple construction. No braces are required to support the end of the board and therefore there is nothing in the way on the under side.

The method of building the supboard, which may be installed in an old as well as in a new house, is made clear in the accom-

panying draw-The diing. menrionu, course, may be varied to suit the builder, but those indicated have been found satisfactory.

The cabinet is the depth of the wall stud-It is ding. lined with 14oe 1/2-in. lumber on the top. bottom and mides: the back is a sheet of neatly fitted wallhoard. The





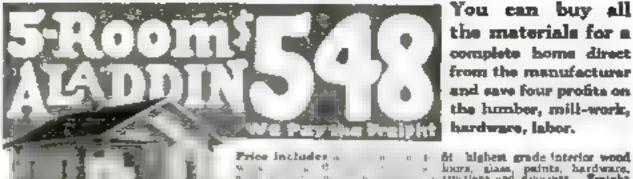
casing around the cabinet matches the trim around the kitchen doors and windown.

Two doors for the cabinet are provided. The top door is opened first. The board steelf then is grasped and pulled upward until the end cleat reaches the stone on either side. Next, the lower door is swung out and the heard is let down on it.

A shelf is provided near the top of the cabinet for the iron and rest when they are not in use. When an electric iron is used, the plug may be put in the wall of the cabinet.-HAROLD J. BAKER, Port Huran, Mich

#### Metal Edging for Woodwork

ROUGH wooden edges sometimes can be finished cheaply and effectively with metal conduit molding, obtainable from electrical supply dealers. I used it recently when building a box for the back of a delivery auto. O. A.



harry, glass, paints, hardware, the third was drawed and drawed and fraction. Frately man and drawed at the same states and states and states and states are same and states are same and same are same are same and same are same are same are same and same are same a ht highest grade interior wood.

Get from Assistan Catalogic



agrants of the first out



Large is no room, business I bedrought, large establishment in the large establishment of design quarters, in the large establishment on the party in the large establishment on the large price tarindes included in the large paint, and in place the end of the large establishment of the large establishment of the large establishment control of the large establishmen

Wilmington, North Carolina:

The ALADDIN CO., BAY CITY, MICHIGAN Portland, Ore. Toronto, Ont.

### Experiments With 110-Volt Alternating Current

By J. D. ADAMS

Here at last is a book that develope a practical working familiarity with the alternating current—the form in which electricity is used in every home. The author shows how this can be done in an interesting and inexpensive way.

256 pages, 135 illustrations. Price, pushpoid, \$1.75

POPULAR SCIENCE MONTHLY 250 Fourth Avenue



face, pleasy of it, in bure

burner or heating stove. Cleen, spinfactory, eco-nomical, convenient or stress heat. Brings happi-

m, phus.

At Last ! Dainty Stylish Shoes Can be Warn With Comfort

# A DAY EASY!

Agents — spiceties. — spare films without we made and well-start which are read latery how well and of shoe hy a wonder file pare to thing this new fixed of shoe hy a wonder file pare to thing this new foot is suid-shied in her tile beather and does away with foot pares he read foot, action to this that they be that asserts a very woman suffers with-no that even don't account an early woman suffers with-no that even don't account an early woman suffers with-no that even don't account process and high quality styling should styling a regiment. Write at once for free mapping and after and full details, he shiftgation. Address

Regar Wilson, STYLE ARCH SHUE COMPANY Clarianett, Ohio



Convert any cook move, range or heater into a real gasstove. OXO-GAS, the chospret, clotmax and most efficient fuel known to science, in trade right in your own stown from kerosene er distillete and eir. Burne a puru, blus flame of high booting incensity as allessly as city gas.

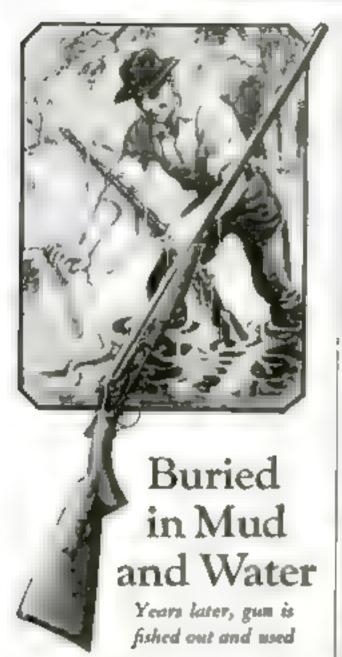
Send for cutalog illustrating and describing currency different, dusting the designs of oil burnies lor Farmaces, Cook Stoves, Heating Stoves, Base Burners, Hot Water Heaters, etc.

AGENTS Some choice territory for WANTED OXO-GAS agencies will open to thoroughly responsible purches. Yourown locality may yet be unassigned.

GLORIA LIGHT CO.



193-8 North May Street, Charago, Illinois Month



A GUN may be down, but it's never out. At least that's what John R. F Workman, of Montana, thinks of the Iver Johnson, Read what he says:

"There one of your shot guns which I recovered from a deep hole in the bed of a lake, after being buried in mud and water for a number of years. This gun was in perfect shape with the exception of the mulnipring, which broke while I was cleaning it. Inside, the barrel is as perfect as if made last week."

#### Iver Johnson Champion Single Berrel Shot Gun

Barrel and lug of high carbon steel, forged in one piece. Elerrat full rhoke which assures close, hard shooting. Adjustable manapring tension but compensating locking built which auto-matically tukes up went safety rebounding hammer plane wire coil springs, heat treated, where necessary, real black walnut stock and trup style formed beautifully finished, growing hard rubber butt plats. Various gauges and etyles—including the Matted Top Rib and the 41h

#### Sand for Pres Booklets

Catalog "A" illustrates and describes liver John-son Champion Single Barrel Shot Quess, Ham-merican Double Barrel Shot

Come and the famous fver Johnson "Hammer the Ham-ther Safety Revolvers. Entalog "B" describes fver Johnson Bleyeles for men, women, boys and girls also Velocionates to little children.

women, boys and girls also Velocipedes for little children.



New Yorks I Chambers St. Chicago i 106 W. Lake St. Ben Francisco: 717 Market St.

### IVER JOHNSON SHOT GUNS

#### Your Tools and Their Care

Continued from page 77)

take the temper out of as thin-edged a tool as a chisel?"

Here Old Prentim picked up a piece broken from a very thin screwdriver Striking a match, he put the tip of the screwdriver in the flame. It was but a few seconds before the color began to run

"There, you see," said Old Prentim, "we have a piece of soft steel-done with a match, too! You don't require a forge to develop heat enough to draw the temper of a tool. Now, if a match will do this. you can imagine what a grinder will do Don't take too heavy a cut or bear down too hard on the wheel, and dip your tool in water very frequently.

"And here's a bint about gouges. I saw Jim trying to sharpen a gouge on a straight-faced wheel. It can't be doneat least, not by the average mechanic There are wheels for the purpose, as well se emery sticks and stone slips for finishing up in place of the usual olistone."

I thought the old fox had run out of opinions on the subject of grindstones,



Hitting a hammer handle violently to drow e stubborn and often maps the wood in two

oilstones, and sharp-edged tools, but just then his eye fell upon a hammer with a chipped face. He was off on a new line

"Now, what do you suppose does that?" I guessed that it was probably a poor hammer. Jim had the idea that It was the sign of old age. We were both wrong

"The fellow who put the handle in this hammer didn't know his job," said Old Prentue. "You see, the face of this head stants up instead of down. Now, when you swing such a hammer on the arc of a circle, so you do when hummering anything, you hit high, with the result that some hard blow on such a thing as a cold chusel, striking off center, will knock off the edge.

"Several years ago I had the job of cutting the keyway in a 24-ft. flywheel. The key was 3 ft. long and 1 14 in. deep at the big end. It took me two days to do it but, although I chipped every hit of that metal out with hammers and cape chisels, I had neither mashed fingers nor a smashed hammer. Whereas, if the hammer had been bung like this one, I might have had both—and still be at the job! Now, if you have occasion to put a handle in a hammer, get it right. Don't have the head at right angles to the handle, but have it turned down slightly at the face 'Then, too, use a hammer as one is sup-

(Continued on page 110)

### **Build Your Radio Set With** Kellogg **Guaranteed Parts**



KELLOGG Inductance Switches are unique in dewith and metch the knobs of the Kallogg dial and rheosest. The switch arm is silver plated in Insure Distribura remeasure. The arm mounts encuraly on the shalt, and a spring which is locked in place by two nuts, keeps the proper tension of the arm on the ewitch points at all times,

Kellogg Switch Points are of brace with a heavy planing of eileur. A low resultance contact in now available for radio work.

The tinned terminal provides for easy soldering. I hey are knurled below the head so that they will not necurely in the panel.

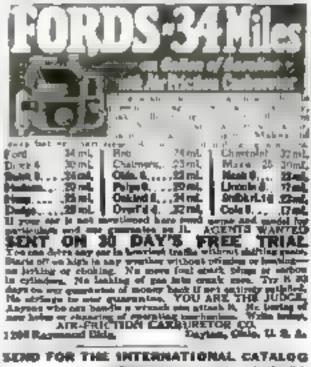
Kellogg Inductance Switch and Points improve the efficiency of YOUR BUIL

If your dealer does not handle Kallogg, communicate direct with us.



Kellogg Initelesant k Supply Company







nutz berlien and recycle

executed Bedr Works. 194 W. Chie St., Best, R. Phinger, Cd.

### Your Tools and Their Care

(Continued from page 118)

posed to use it. The side of the eye was not meant to be used as the face, nor was a hammer meant to be used as a maliet when chiseling, nor the ordinary claw-hammer as a hatchet for ripping apart boxes, and things of that nort. You wouldn't expect to use a little bit of a clawhammer to pull a large spike. Get a nail-puller for that purpose; you will save in the long run.

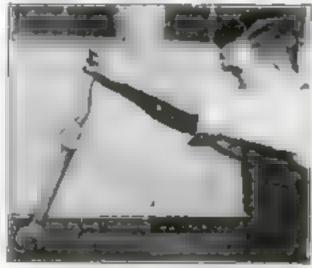
"Only the other day I was speaking to a manufacturer of hammers and he told me



A wrench is turned as of the right, and not pulled backword, no at the int

that one of his products came back from a carpenter who had used it for 17 years. While the quality of the hammer undoubtedly had something to do with it, I am sure the most important thing was the care the owner gave it.

"Speaking of hammers," Prentim went on; "a monkey-wrench never was designed to take the place of one. It was meant to be used to turn nuts only. In using a monkey-wrench, the jaws always should face in the direction in which the wrench is to be turned. If the jaws face in the opposite direction, the tendency is for the jaws to spread. This puts an additional strain upon the weakest part of

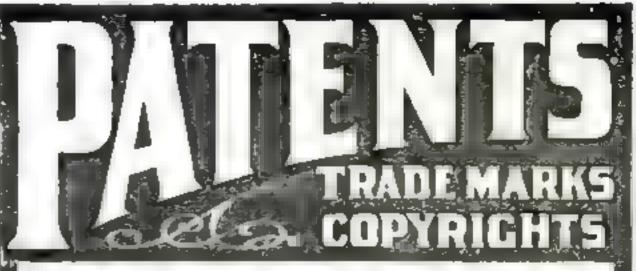


Eneggerated for exophasis, this illustrates one of many ways in which wrenches are abused.

the wrench. Moreover, by using in this way, it may cause a slipping of the nut, and that damages both nut and wrench.

"It frequently happens that a nut is to be turned with an open-end wrench and that none can be found that fits exactly I have seen men try to drive the next smallest size wrench down on the nut with a hammer. This not only aprends the

(Continued on page 120)



### PROTECT YOUR IDEAS

ANY NEW article, machine, design of improvement thereof, or any new combination of pasts or improvements in any known a sele which increases its efficiency of the last, may be patented, if it involves the last.

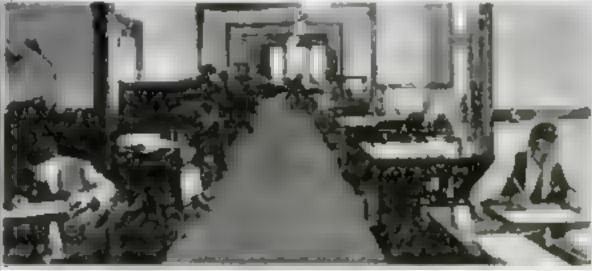
### If You Have Any New Ideas

which yet or are note practical and novel, take prompt action to protect your rights.

I was invented any new machine, or new combination of part of the combination of part of the combination of any new descense process. Si ND DRAWIN s, MCDLL OR DESCRIPTION of a second process.

#### Write Today for Blank Form "Record of Invention"

USE THE COUPON attached, and now the courts receipt I shall send you this form to be returned to me with drawing description or model of your idea; promptly upon receiving your idea I shall will you fully as to procedure



BEIR INC. and APPOINT ABOVE OF CARREST & G. BRICH. Regulated Pains, edward Waldergon, D. C.

#### No Charge for Above Information

All communications are his translation of the property of the

### CLARENCE A. O'BRIEN

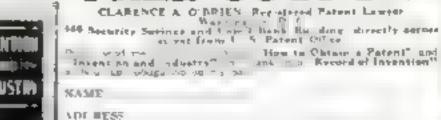
#### REGISTERED PATENT LAWYER

Member of Bar of

Court of Appents, Dustrict of Columbia, United States Court of Claims, Supreme Court of United States, Supreme Court, District of Columbia

Practice Confined to Patents, Trade Marks and Copyrights





Impaction. We also seek

A I an of a Write TODAY



### SUPERIOR CONDENSERS NEW Combination Types

I.W points of strength added to a still greater development of the exclusive Rathbun features that have won such wide recognition for these condensers. The vernier attachment is so utterly independent of the variable elements as to be practically a "condenser within a condenser." Neither shaft can move the other. Vernier contact fully insulated from rotor contact. Vernier capacity of only 200002 mid affords the most critical tuning. Other points of these new condensers are, the smallest amount of Bakelite for dielectric consistent with strength; positive contacts (no current through bearing); all metal parts of brase, bronze and aluminum assures minimum resistance; contacts from rotor and stator plates widely separated for high efficiency: and of course, SINGLE HOLE MOUNTING. You'll never know just how good a RATHBUN Condenser is, until you've tried one.



### Field Types Ploto Vermine Place Vatable Place Vatable Place Variable Plate Variable Plate Vertable

Combination Versier Types 3-21 Vernier Vertable 3-28 Vernier Vertable 3-43 Vernier Variable Combination Types Include East and Dist

Write for Literature TODAY





### They Will Raise Your Pay! GET PREE CATALOG

The books flowed below will gardent you in your chosen trade space the way to the big positions. Written in mon-trebutes language setty to read and student and. Every book covers for subject completely. An antice course of instruction condensed into one reduces. Your bujec sent part and you benefit 5 days make refused a sail if not energy satisfactory. Order direct from this page Of 5-DAY THIAL.

AUTOMOBILE GOOK	US.
Abstromabile Studien, Lante	
inn and Ignition, by Marry	41,00
Breaked' Astanoulable Haral	rh men
For Moving Car Track and	2.00
Tractor by Mandy Chilli	1.50
Starting and ago by Temp-	
for Manty Len beer to	1.00
An omessile flattery Copy and Manily	
I mad permit se	2.00
There and Antequality by Tuffering There	2.50
Cas will Oil Engine Hard	
Aux mobile Uphrest and Lare	1 50
Must be 50 Buttelburgh, by	1 50
Manth Relationship	1.50

Len bere to 3.00	ELECTRICAL BOOKS
In they Cope by Manily I sallware to the first by The his The	Telephony. Inc. Automatic J. State hing, by Spainh.  Fractical Applied Electronity 2 00 Air material Applied Electronity 2 00 Air material Americal Systems. I 50 Electronic Motor Control Systems. I 50 Within Disattation and Dec. & Spitems. I 30 Arms are and Monart Wind.
Victor Sooks Victor Man- ratherage \$2.00 Welding and Leatherage 1.75	Modern Electrical Emptyre 150 Modern Electrical Emptyre 150 Modern Electric (Burdination 150 Electricans Uperating and Testing 150

4.00		
Motion Picture Operation	-1	50
Brahe p F to recal the transfer	H	10
Fire trick 50 strate 15 days.		10
The struct to sourcements and		
All the less than	- 1	30
Druke a Tricohone Hamiltonk	- 1	Jan
Lary Dect scal Laborimones		
( Ir A In	-1	24
Telegraphy Sell Taught Cloth	- 3	15

### PARITING BOOKS

-		The Mixton of Colors and	
	10	Plater	\$1 to
	90	Server Painting and Bulletin	
л	50	A21 Joth	4 00
	1.0	A Show at Sher Carde Clinib	4.00
	30	Night Party that Cloth	4 00
	E erb	Strong # Hook of Deserte	
	30	Lara being se	4 00
	30	historial a digitaliera il irli	1 40
		Materia III p 1 a 4 selopedas	2 00
	10	And managinal Countries (Charles	J 3a
_		Estimates, Cours and Prict a	-
	50	Paletter and De w nor	1.30
1	.5Q	New Parlment Photogram	1 40
		The Amstern Artist   1 help	1 13
п	50	New Scenetie, Cloth	1.20
			4.20

#### Bhret Mrist W ual Ony Amtriene Cutting 1.50 THIS PAGE-ON OUR ORDER DIRECT FROM MONEY-BACK PLAN

Hitier Rule and Logarithmic Tables | Logarithmic Rule | Millimstan | Williamstan | Wilse |

ELECTRICAL BOOKS

Muil Coupon for FREE Catalog Vans Guide to Home Study

PREDERICK J. DRAKE & CO. 1901 Mahiyan Assenta, Chicago, 30.
GENTLEMEN from send me free postage pulls your il metro ed carabones which have and
describes over 130 Practical Mechanical Books for Bone Study
Mama

Address

# The broke heard above are only a few of the many in our catalogue which roo will receive promptly after filling as and mailting as the astached cuspus. For quick action order direct from this rugs, strain having of each book manual and small in with price quoted. We prepay posture and ment the books on our filling bush plant.

FREDERICK J. DRAKE & CO. PUBLISHERS

1003 Michigan Ave., Chicago Dealts Broke Are for Sale at all Back Stores

#### Your Tools and Their Care

(Continued from page 119)

jaws of the wrench, but it also rulns the jaws on the and where the pounding is doze, so that the antire wrench is damaged as a result

"Sometimes a mechanic will grind down the jaws of a wrench to fit a particular nut; thereafter it will never fit any standard nut. In order to get more leverage, he may resort to using a pipe for a lever, slipping it over the end of the wrench, or of booking two open-end wrenches together so as to get the added leverage. A wrench is designed to withstand a certain force applied at a certain particular point on the wrench in order to get torsion of a definite amount. As soon as the leverage is incressed, the capacity for producing this torsion is increased. whereas the wrench is still the same old wrench and cannot stand that much. If the wrench happens to have hard metal in the jaws, the result is, of course, a broken



Pushing heavily on a wood bit is unmecessary and often bends the shank

wrench. If the metal happens to be soft, then we have a spread that looks like a V

"Then there is another one of our much abused friends—the screwdriver. I have seen more than one man pry open a box or a trate with a acrewdriver. You've probably seen it done, too. First be tries to pry underneath the board and finding that it does not work, he takes a hammer and drives the acrewdriver between the boards. Of course, the handle does not always break, and he may not have succeeded in demaging the tool at the first blow. Then he sits upon it, or at least he presson down with his entire weight. There are few screwdrivers that will not bend under these abuses, for the screwdriver is a torsion instrument and is not to be used as a lever

"Even in using a screwdriver for the purpose for which it was made—to put in and take out screws—a number of abuses occur. When a screw is rusted so tightly in place that not enough torsion can be put upon the tool with the hand, a favorite stunt is to use a wrench or a pair of pliers. A screwdriver that will not fail under about 150 inch pounds of torsion is a pretty good one. I assure you that it does not take very much pressure to exceed this, when you use a wrench or a pair of pliers. The result is, of course, a shank twisted beyond the electic limit or a bent

(Continued on page 121)

#### Your Tools and Their Care

(Continued from page 120)

blade, provided the screw head itself does not fail first. A few taps on the screw head often assist greatly in loosening a screw

"When the point of a screwdriver in too hard, even the best of care may not prevent its snapping. Grind it up immediately, being careful, as in grinding cutting tools, not to draw the temper. Also, the screwdriver should have a relatively blunt point. It may seem rather ridiculous that I should mention it, but you would be surprised if you knew the number of 'outting edged' screwdrivers in use today. Grind the sides straight and parallel for about 1/4 in, and let them taper back after that.

"If the handle becomes loose and is not built into the tool," grind down the shank of the tool so that it has flat faces similar to a file shank. Then drive it into place and fill the crevices with hot rosin."

Prentiss now launched his last attack against the Gibraltar of our inexperience.

"Take a saw—do you know how to care for one? I don't mean charpen it, for I'll admit that is an art that can be mastered only after many trials and even more errors. I mean ordinary care.

""THERE are many ways in which a saw can be damaged. One of these is to use too great a pressure in an effort to make it saw faster. Especially is this true in starting a cut, for pressure will cause the saw to move away from the line; then, in foreing the saw back on the line. you will cause a sort of kink in the blade and the chances are it will cross the line to the other side. In that way, it will sigsag back and forth rather than cut straight. Allow the saw to do the cutting by its own weight until the blade is laterally supported by the saw cut. Thereafter a little more pressure can be applied to cause the saw to work faster

"Keep a saw sharp by all means, for the tendency is to ride a duil saw more than a sharp one. It does not take a great deal of buckling to give a saw a permanent set; even though it may be slight, it will grow with use

"After completing a job, a cost of thin oil should be spread over the entire blade, because rust is a tireless and removaless enemy of tools. I once losned my pet saw to a neighbor. He returned it a week later, covered with rust. I questioned my wife and she informed me that the neighbor's wife had used it to saw a ham bone. That explained it. The sait had eaten into the blade and even had attacked the teeth. No amount of emery cloth could restore the saw. It was done for

"There is only one rule for a mechanic —buy good tools and treat them well! It is cheaper, your efforts turn out better, and you get much more pleasure out of your work."

A MONG the Home Workshop features scheduled for early publication are: "How to Make Craftsman Dinner Gongs," by J. T Garver; "Stenciling Woodwork with Sunlight," by Ernest Bade, Ph. D; "The Secrete of Successful Upholstery," by William T. Weld, and "Automatic Fire-Alarm Signals," by L. B. Robbins.

# PATENTS TRADE-MARKS

### **OUR OFFER:**

NO CHARGE FOR EXAMINATION AND INSTRUCTIONS.

### HAVE YOU AN IDEA?

YOUR FIRST STEP before disclosing an invention. The inventor should write for our blank form—

### "Record of Invention"

This should be signed and witnessed and returned to us together with model or sketch and description of the invention for examination and instructions. No charge for the above information.

# Our Three Books Mailed Free to Inventors

Our Illustrated Guide BOOK

1-How to Obtain a Patent

Costa as full instructions regarding U.S. Patenta. Our Methods. Terms and 100 Mechanical Missemens all usetrates and described, Articles on Assignment or SALE OF PATENTS, Patent Practice and Procedure, and Law Points for investors

#### 2-Our Trade Mark Book

Shows the value and necessity of Trade-Mark Protestion and gives information regarding Trade Merks and anfair comto tion in trade

#### 3-Our Foreign Book

We have Direct Agencies in all Foreign Countries.

We secure Foreign Patenta in shortest me and lowest cost



Our Main Office, in the Victor Suliding (Opposite U.S. Fatent Office), Washington, D.C.

WE REGARD A SATISFIED CLIENT

As our best advertisement, and will furnish to anyone, upon request, lists of clients in any state for whom we have secured patents.

Highest References Frompt Attention—Reasonable Terms
WRITE TODAY

### Free Coupon

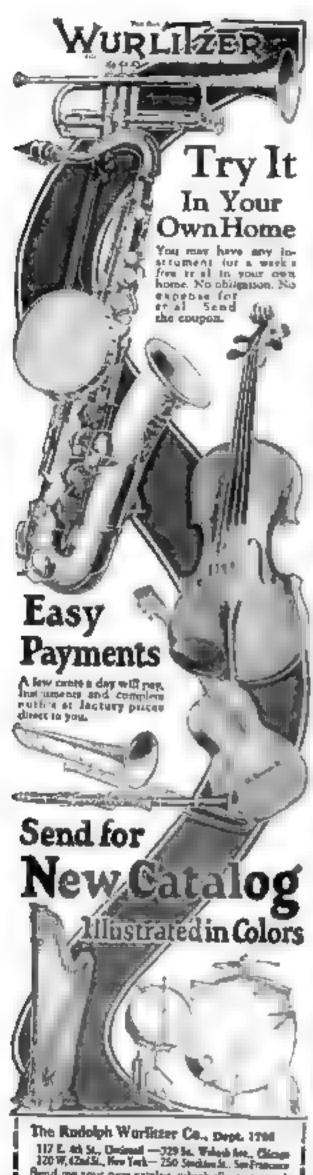
### VICTOR J. EVANS & CO.

Patent Attorneys

New York Offices Philadelphia Offices Pittsburgh Offices 1997 Woodworth Hidg. 714-715 Liberty Edg. Pittsburgh Offices 314 Employ Bidg. Chitago Offices, 1114 Taccom Bidg. Sun Francisco Offices. Hobert Bidg. Main Offices: 760 Ninth Street, Washington, D.C.

Gentlemen. Please send me FREE OF CHARGE your books as described above.

Name...... Address .



The Rudolph Warlitzer Co., Dept. 1766

117 E. 4h St., Ordend — 329 St. Which for., Gloge 120 W. (Zaddi, New York — 250 Steckies it. Surfrateurs and describes every lapour manical instrument money of them shown in full colors, all at lowest factory prices. Also tell me how I thay have any instrument on a week a trial in tay own home at your expense and without obligation, and may pay be it on patte special may payment plan.

Malater -	—		
Address	we.	****** ***	

The amoun

### Farm Lighting Plant Furnishes Current for Radio Set

By H. Leslie Curtis

THERE is an interesting field of experiment open to those roral dwellers who possess the happy combination of a radio set and a farm electric plant. Under certain conditions the two may be combroad in such a way as to eliminate the A-battery puisance.

My own radio set is supplied with filament current from the electric plant and gives as good results as I ever attained through the use of a storage A battery, even when using a soft tube that is conadered very sensitive to changes in filament current.

The set, however, cannot be used while the generator is running. Therefore you can useonly a direct-current plant equipped with storage butteries. It would not be economical to use a plant of more than 32 volts. Any considerable change in the load on the lighting plant probably will necessitate a readjustment of the filament rheestat or the regeneration control. A motor running would be apt to cause unpleasant noises in the head phones.

Probably you also will find it necessary to use a book-up in which the filament circuit has a metallic connection with



A berrery troubles may be eliminated in ferm-houses that have small electric plants

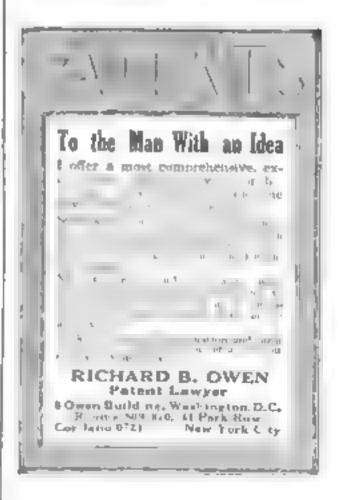
I mean that there must be no condenser or other gap in series with the ground that would break the metallic connection between these points. Otherwise the counterpoise effect of the house wiring system, which is sure to be present, even if the wirse are not accidentally grounded at some point, might weaken seriously the signals.

The single-tube hook-up presented by Joseph Calcaterra in the January, 1924, issue of Popular Science Monthly fulfils these conditions and gives excellent results when used in this way. With it I have heard KGO at Oakland, Calif., twice in three days. From central New Hampshire, where I live, to California is all that could be desired of one tube. Of course, this is by no means an every-day occurrence.

You must use some sort of resistance to reduce the voltage of the lighting system and protect the tube. I use a lamp bank, but a coil of resistance wire or a carbon-pile rheostat would be better. The amount of resistance necessary de-

(Continued on page 123)







# PATENTS PROMETRESS MARKET PUTENERS IN

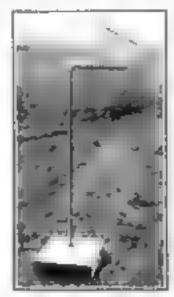
firmi drawing or model for examination and report as in patentability WATSON E. COLEMAN, Patent Lawyer

644 G Street N. W., Washington, D. C.

### Improved Movable Mailbox Designed by Letter-Carrier

A NEBRASKA letter-carrier designed the movable mailbut illustrated so that when a rut forms in the road alongside the box, the stand can be moved a few feet away. Ordinarily after every rain the letter-carrier must drive his car

in the same track day after day until the rut mea deep that his car eventquily strikes the mailbox, or he has to keep so far away. from the box that he cannot reach it convenleatly. Another advantage is that if the box is in the way of road graders, it can be set saide until the machine goes by.



The southest has a heavy concrete has

The cement base is 16 in.

square and 4 in. thick, cast in a form of four 1 by 4 in. boards held together with three hinges and a hasp and staple. The lower and of the pipe standard is split with a hacksew and spread out to form a key in the coment. The box is fastened to the split end of a shorter length of pipe, which is attached to the upright with an albow.—Dale R. Van Honn

### Wire Egg-Lifting Tongs

L IFTING eggs from boiling water is not difficult if wire tongs are at hand. Each end of a 28-in, piece of wire is bent to form a loop about 1 in, in diameter



The wire is then bent in the middle, two turns being made about a small stick to form a spring.—L. R. BUTCHER.

### Farm Lighting Plant

(Continued from page 122)

pends on the number and kind of tubes used, and on the voltage of the lighting plant. If you use a lamp bank, remember that the resistance of a lamp is much less when cold than when heated. Therefore arrange a switch to short-circuit the tubes until the lamp filaments are hot. Failure to do this may mean a ruined tube.

Always use a test lamp of the same voltage as your tube in place of the tube when experimenting. Also keep an eye on the meter of the electric plant and see that no more current flows than is being used by the tubes. If one wire of the lighting system is grounded somewhere and you ground the other through the radio, enough current may flow to waste to darcharge the batteries or do other damage.

# PATENTS

# Seventy-eight Years of Practice

THE firm of Munn & Company filed its first application for a patent in 1846, and for seventy-eight years has endeavored to keep pace with the inventive genus of the United States. An experience of many years is at your disposal. If you have an invention which you wish to patent, send your sketches or model together with a description of your device, explaining its operation, and you will receive prompt, courteous attention.

# Write for our Handbook on PATENTS

A full and complete booklet on Patents, Designs, Trade-Marks, Poreign Patents, Copyrights, Labela and Patent Office Practice with an explanation about our methods, terms, etc.

All communications strictly confidential

Keep in touch with the inventions of the world by reading

### SCIENTIFIC AMERICAN

The MONTHLY MAGAZINE with a special appeal to every man of inventive genius. Recent rulings of the Patent Office, descriptions of the latest patented inventions, legislation and court decisions affecting patents, are noted in this authoritative publication.

### **MUNN & COMPANY**

Patent Attorneys

683 Woolworth Building, New York City
Scientific American Bidg., Washington, D. C.
Tower Building, Chicago, III.
Hebert Bidg., 582 Market St., San Francisco, Cal.
Van Nuys Building, Los Angeles, Cal.

MVENTODS	PROTECT
NVENTORS	YOUR IDEAS

Send for our Guide Book, HOW TO GET A PATENT, and Evidence of Invention Blank, sent Free on request. Tells our terms, methods, etc. Send model or sketch and description of your invention for our Examina-

your invention for our Examination and Instructions without charge.

RANDOLPH & CO. Dept. 130. Washington, D. C.

STEERE

CITT

STATE.



### "We pay him \$100 a week"

AND he's worth every cent of it. Came here neveral years ago asking for a job. He got just that—a small job at a small estary

"Then I forgot about him—hardly knew he was on the payre, un't one day I got a letter from the International Correaportion of Schools telling no that he had carehed for a course of home study It was remarkable the way he went shead

"We pay him \$100 a week now and his going to be earn not oven a larger salary are a day I wish we had hore and day like him.

Hith do you stand when your employer checks up that men for permission? Here he think of your In there may remon why you should be wireted. Ask yourself these quantums larry You must have You must fare them If you expect advancement and more money

One hour after supper rock hight spent with the 5. In your own home we the are you far the position you want in the work you ike best.

tre, it will I but it up to ter to prove it. Without cost or objection, just mark and mad that the respon-

INTERMATIONAL CORRESPONDENCE SCHOOLS Without cost of obligation on my part please tall ma-how I can que ity for he perturbed or in the subject before physical base marked has 2

BUSINESS TRAINING COURSES Thurleman Man general

Indian that he content

Indian that he content

Indian that he content

Indian parameter

Indian Hughens Man general lender von dem general decentaret (o.g. n. catali Teglie Management

TECHNICAL AND INDUSTRIAL DOURSES

Mechanic For tenting meetric Lapiting Mechanical Engineer Stockers Davisting Mechanical Practice Machine Fasting Practice Practic Merchanism Routheet
Mertanism Routheet
Mertanism Destroism
Merchanism Destroism
Fasting Paultinus
- as Kouter Operating
- " Construct
Sucreying and bigogists
Statulismy D Maring
Missan Bactoserian D Sadde Architects Filter for att anne et a a de la desire de la desire de la de

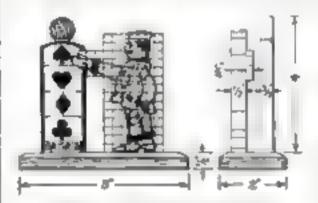
Name of Contract of the Contra	)	ė.	24
Olympia was as a william -		111.M	r
Becapetion.  Propose parishing in Florade should send this real functional Cattangung new Schools Canadism, Mantreal, Canada	Ť.	₿₽ mpd	file led.



### Traffic Policeman Signals the Suit that Is Trumps

AN ODD and convenient little indicator for reminding card-players of the suit that is trumps in shown in the accompanying illustration. A touch of a pencil will move the arm to indicate the proper trump. "No trump" is indicated by placing the arm in a vertical position,

The base is 1/4 by 2 by 5 in, with a bevel running around the top edge. The signal tower is 14-in, material cut with a copingsaw. The figure is laid out on ly-in stock by means of squares. Each square in the



Front and side views of a novel hom made indicator for the cord table

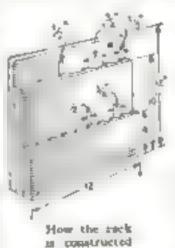
illustration represents 14 in. The figure is then cut out with a coping-caw

The arm is 🦮 in, thick and shaped as shown by the dotted lines. After the arm has been cut out, it is far cened in the proper position rather tightly by a nail or serow. The tower and policeman are attached to the base by nails driven up through the bottom.

An attractive color scheme is obtained as follows: Paint the base black and the bevel red. The figure should have a blue uniform with black trimming, and white gloves. Shoes, of course, should be black. The tower first is painted cream color: then the edges and base border are painted black. The club and spade designs should be black; and the diamonds and hearts red. The globe should be green with the cream showing in vertical streaks, as indicated. - KENNETS R. LAVOY.

### Pantry Rack for Knives

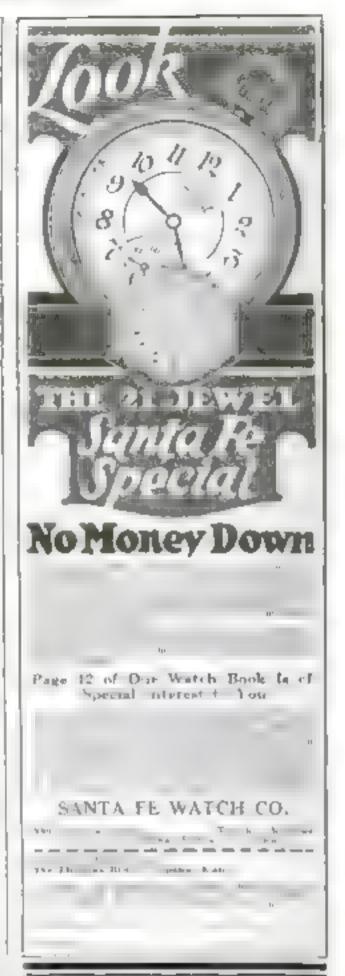
DULL knives usually result when all are thrown together in a pantry knife-box. They are a source of annoyance to the hurried housewife and to the patient or impatient husband who tries to keep them in working condition.



Hetter than a box is the double deck wall rack illustrated. The back piece in la in, thick, the first and second pancls are 16 in.

The knife slots either can be grooved in the panels or la-bybyim, strips can be nailed or glued on back of the panels to form

openings. In the latter case, all the panels can be la-in, stock. Let the slots extend the full height to allow any material adhering to the blades to drop down. - DONALD D. SIMONDS, Worcester, Mass.



# Patent Literation

R. H. FRAVEL, Patent Lawyer water of the P. Patett Mer Constitue. WASHINGTON, D. C. Name 2503 McCarbian Bldg.

ENTORS who derive large and head certain applying for Palenta (kur book Patent Same gives those facts; seet free, Write LACEY & LACEY,

### PATENTS

TRADE-MARKS, COPTRIGHTS AND PATENT LITIGATION When they are proceed certs, ste.

It and front with fluctuations of 100 Mechanical fluid front with fluctuations of 100 Mechanical fluid front west free on repart.

ALBERT R. DIETERICH

Partent Leaven and Solicitor

Successor in Find G. Distorich & Co.

WASHINGTON, D. C.

### Sky Sports of Tomorrow

(Continued from page 27)

The Vedette lifts, in all, a total of 2944 pounds, of which 794 pounds can be used for passengers and baggage. It is just right for a week-end cruise or a picnic An oir yacht, so to speak. Some idea of its dise may be obtained from its capacity of 141,280 cubic feet, against 5,000.000 cubic feet, which is the figure for some of the large mulitary dirigibles that have been designed. Its length is but 190 feet. diameter 39 feet

Thus we have actually in existence an air yacht capable of stowage in a garage of convenient size and fully able to meander down the bay on a holiday afternoon or to carry the owner and his sporting friends into the trackless wilderness after big game. Its speed of 50 miles an hour lends itself to sporting possibilities in the class of amateur contests.

NOW let the two paths of air sport converge and see how bright the almost immediate future looks. From balloon Jumping and swimming, athletes can evolve games analogous to football and baseball. Instead of ground rules we shall have sky rules. Bright-hued smoke signals will lend color to the scene.

Certainly there will be developed some form of paddle attached to the player's hands or forearm to enable him to make approciable speed. This suggests also that the form of a supporting balloon may be streamlined. And, further, that the style of "air stroke" may be something more graceful and more effective than either the crawl or the trudgeon.

An individual motor-propelled balloun of this sort always has been a great medium for the cartoonist's pen. As a matter of fact, it is very doubtful whether that convenience in vehicles is near at hand. Too many unhappy possibilities loom up when we think what motor trouble would mean. There is, however, a great opening along the line of a sort of "aerial surfboard." Study of the principles of heavier-than-air guiders surely would lead to using those same vagrant air currents as leisurely agents for dirigthle propulation.

Gliding and soaring already have come into their own abroad. But such engineless contraptions always will be too dangerous for the general public.

THESE new air sports with small balloons will be cheap. Quantity production will put them within the reach of every flivver owner.

Heilum always will be used because it is so safe. Before the war this light and non-combustible gas cost \$2500 a cubic foot. Now it is down to less than seven centa a cubic foot.

So before long we won't have to crane our nacks to watch the big events of the sport world. In our air yachts we shall be up in the sky where the games are staged. And even if we are on the ground we shall be able to see games played aloft better than we now see games on earth from the grandstand. And when we feel the need of a bit of exercise we shall simply strap on our air preservers and foll in the clear depths of the blue sky

ONLY

and you keep this typewriter

Our Pactory

Every MACHINE is tully gut and meeded. New quarts are meeded. New dramel, new mickel.

new lettering, new platen, new key

rings, new type—a complete, per-fer typewriter in passible to left is from a brand new Ludersenid

either in appearance, durability or

An ap-to-date mechan with two-per elicies, back spaces street for the optomatic elicies reverse takes fatur etc. In addition we foreign Fatta subsequent cover and special Touch Typewetter Insurantian Back.

You one have to specule this Underwood to one day.

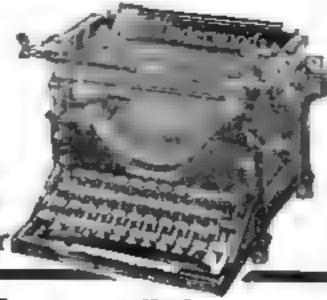
Big Book FREE

Our big, handsomely illustrated gatalog will be wrot free on request. It tells you aid about the aid and are to be to the property of the best of the

of owning a STANDARD SIZE UNDERWOOD how and why this machine will last for years, saving many dollars not only in the pur-thase price, but in its operation.

Send in the coupon and fee up send you this braut July Stuttmend brok FREE without any obligation.

quality of finished work.



DIRECT to you from our Factory

Big Saving in Price

### Yes, we will ship you this Genuine Underwood

Rebuilt in our own factory just like new for ONLY \$3 down—Not One Cent More

Until you have tried the machine 10 full days at our expense

Write Right Now and trace bow It to possible for up upon our free tred plan our direct to you manage man toll eigh the c super ares decide.

> No Obligation n-to ham. You day have to order Josef sign the cou-past, hard it is us said up to ill read you out him outside shoulding taking abundaring rea. You will be arrived at the liber along of more affect the beauty of more and all arrested an allegate of

Send Coupon Today for 10 Days

Free Trial You have ten full days in which to try the typewriter before you decide whether

you want to keep it. Give it every test- see for yourwell make the Underwood prove its worth to you. Do not take our word for itput the Underwood before you and are if you don't think it the greatest type-

This is the genuine Underwood Typewriter. We offer you the same three models of the Underwood Typewriter bring made and sold by the man-plantarers today. Standard four-pow single shift beyboard. A loc-lutely simile writing, the full lines of spewriting invisible at all times. All the improvements and attachments that nov high grade type-writer ought to have.

### Big Saving to You

Our plan of selling to you direct makes possible enorment alvenge, which are all for your breeze. Send in the ocupant and we will send you propald our lag cataon, including. A Trip Through Our Pactury. This shows how the Shipman Ward Relault Underwood is the best that can be produced at our Special Price.

don't have to do a You thing to get our his complete details of our amening typewriter offer except

stan end No obligation. 4

SHIPMAN-WARD MFG. CO. 21 of Shipman Bldg., Chicago THE PART PART OF THE PARTY OF T

whatever SHIPMAN-WARD MFG. CO. Extended from

if on your feet more or less an only apply Abust one. Ir You almost for that but fired aching feeling disappear as the muscles relax their tension. A south ng cor og sensa-tum comes qui kly-and

affords lasting rebel All drugger', \$1.39 or peopoid. Leberal treat faute roc. peopoid. W F YOUNG (N 350 Lyroan St. Springfield, Maye.

Pin oles

10r

Hunt with a BIASCOPE 5 Sa cower Power Fonocular for all sportsmen, naturalists, etc. See game from plar \$9 and \$7 at dealers. Dones, old 250. Money-back guarantee. Consider from. Wollensak Optical Compuny



### **Heats 7 Rooms**

at about the

### Cost of One!

"With the Buildog Furnace, we find it takes lit le more coas to beat the whole seven room house than it did to heat one room with a stove using chestnut coal." J. B. Smith, 19 Elm. St., Somervide, N. J.

#### More Heat with Half the Coal

"I had a hot air furnace in our house before I got the Buildog and our 7-room house was always cold. With the Buildog it only takes half as much coal and we had weather below zero, and the house was nice and warm in the morning when we got up. We never have the draft on more than a half hour at a time, and it has the place red hot." Jees T. Conrad, Shamokin, Pa.



### Comes Completely Erected! You Install It Yourself!

If you are even thinking of a pipeless furnace is any furnace weste for our free is a lost. The building is one furnace you Mi. T investigate. Comes completely reacted, I in any height of business, goes through one down, and you install it posterial!

### No Money Down!

The Buildog is sent you for five inspection. Then if barraired you make only bound mouthly payments, at our amortingly fow price! Factory connections in both East and West. We stop from nearest point. On a consider buy on any furnace upon you find our about the Buildog. Write at once for our special offer and our free catalog together with the wonderful record of Buildog success. Get rendy for winter NOW! Mail this coupon for AY!

	Ba	bson	Bros.	-
--	----	------	-------	---

19th & California Ave., Dept. 13-66 Chicago Without obligating me in any way person need me year free catalog and special offer on the Unit-of Pipelogs Parance.

Prod	 	priority by

\_\_\_\_\_\_\_\_\_\_\_

Name
------

### What Paint Means in Your Life

(Continued from page 30)

Mr Gardner told me of researches that have given the industry special points that dry with autonishing rapidity.

"It is probable that new forms of the apray machine will work extraordinary changes in our whole painting scheme," he resumed. "Today in some localities the consumer is asked an exorbitant rate for a painter with the hand brush. So nearly prohibitive is this cost that in country districts farmers and house-owners generally have let their buildings deteriorate.

"As USUALLY happens when a need shows itself, acience came to the rescue with a portable spraying machine, mounted on a motor truck. It is said that some 300 community painting machines now operate in the country districts of the West, mostly on farm buildings. The rapid growth of this method seems certain.

"I know this will not work disaster to painters. On the contrary, spray painting will enormously increase the use of paints and, correspondingly, the field of the painter—just as the sewing-machine enlarged the demand for factory garments.

"Experiments show that one of these portable agray machines operated by one man upon large areas of unbroken surfaces will do the work of four or five painters, although the paint consumed is about one-tenth more than that used by the hand brush. There is practically no difference in the appearance of the work."

Experiments to discover the effect of paint colors on temperature, health, growth, sound, and light have produced interesting results.

"Tests were made to ascertain what effect the color of a steam radiator might have on its heating capacity," Mr. Gardner told me, "and a difference of 20 per cent was found between white painted and supposted iron radiators; the white giving the greatest radiation. Between these two, the following colors, in the order given, showed more or less difference in radiation: Cream, red, green, yellow, black, aluminum and brown.

"Statt. AR experiments were made with colored paints on small metal tanks of naphtha. Temperature readings were taken after exposure of the tanks for two hours to the sunshine. Those painted black showed the highest. Next in order came bright red, dark red, dark green, battleship gray, tan, cream, pale blue, and white. There was a total difference of 11 degrees in favor of the white. This meant that the darker colors caused greater loss of naphtha through volatilization. With black, the loss was nine per cent; with white, only four per cent.

"Work on sluminum paints has indicated their value in cutting down the ultra-violet rays of light. Application of the principle was made in costing the surfaces of balloons and airplane wings to prevent the rotting of the cloth fabric and to minimize the temperature effects upon the gas cells.

"Research in connection with point vapors demonstrated the disinfectant quality of paint. Vapors of the drying oil in paint were found to contain formal-

debyde, and therefore it is used in hospitals and homes in place of chamical disinfectants.

"Another series of tests had reference to the effect of paint colors on human growth. Rabbits were placed in large boxes, painted in different colors. It appeared that light colors of high reflection value were most favorable to rapid growth, while colors of low luminosity

exerted a retarding influence.

"The effect of colors on the growth of plant life also has been tested. Potted belladonna seedlings were placed under porous paper cones of sufficient height and width to prevent interference with growth. The interiors of the cones were painted white, red, orange, yellow, green, black, and purple-tone blue. In three days evidence of plant fatigue became apparent under the blue. The leaves blenched to light yellow, and one broke from the stem. Under the green there was some yellowing. though the plants were in good physical condition. Each color had some effect. Application might be made in the coloring of special plant breeding boxes.

"INVESTIGATION of the effect of paint on sound yielded unexpected results. In a certain church acquation were very bad; echoes were everywhere. After several coats of a supplied paint had been applied to the walls, there was material improvement.

"In another case, diners at a certain country club were annoyed by the habel of volces. Celling and walls were given two additional beavily stippled coats of paint, and the change was marked. Again, when the walls and ceiling of an auditorium were changed from smooth plaster to a rough finish, reverberations were much reduced.

"A test was made to discover what difference there might be in the effect of wall finishes on sound. With a plain metal wall, sound carries 40 inches; when the metal wall was conted with a sand finish, 19 inches, with a sponge-finish paint, 18 inches, and with paint in cork finish, 14 arches.

"THE possibility of having walls so painted that they yield by reflection 86 per cent of normal light is important Experiments showed that in a certain room painted with ordinary white, four 100watt lamps were necessary for Blumina-Through the application of a non-yellowing paint only three 100watt lamps were required. Paint substances have been found that stay white ! and keep their reflection value. The difference between well-painted white ceilings and ordinary light buff, for instance, may increase illumination from 20 to 30 per cent where semi-direct or , um ar lighting systems are used

"Studies are now under way to prevent the fouring of vessels. Thousands of chemical and biological experiments have laid bare the harits of marine animals. Barnacles live only in the harbors—they do not venture beyond the 'three-mile limit' except as passengers on ship hulls.

Continued on page 127)

### What Paint Means to You

(Continued from page 126)

"In these experiments thousands of metal panels were coated with paints of different formulas and submerged in harbors for varying periods. The formulas showing the least fouling were retained for further experiment, and through this process have been evolved paints that solve the problem to a great extent.

"This study told us many things. The young organisms reacted to various stimuli such as light, color, and chemical substances—in different ways. In come experiments with anti-fouling paints the harnacles reacted negatively. Again, they were so injured that they lost the power of reproduction or died and dropped off

"ONE experiment was made with a deadly chemical substance developed during the war. Through some curious contradiction of nature, barnucles waxed fat on paint containing this acld. Something like 300 different poisons have been tried in our tests. Dark hues usually revealed a tremendous fouling of the metal with barnacles and other sea creatures, while colors of high luminosity showed comparatively little.

"A study of rolor preference of the lower forms of animals also has yielded information of practical value. Certain species of crustaceans showed a marked preference for colors of low luminosity

"Other fruitful experiments have been made in the development of protective coatings for wooden underwater structures. One of the most destructive creatures of American harbors in the toredo-an animal that delights in honeycombing a wharf foundation

"Fire-retardent paints," Mr. Gardner told me, "have been evolved through re-

peated tests."

A full recital of paint achievements would include almost a catalogus of paints and varnishes—for innumerable specific uses. You hardly can find any ourface for which a paint or varnish has not been apecially devised.

DIFFERENT woods and metals call for different technique in painting, and perhaps require special paints. Or different conditions in the same wood may indicate some particular treat-

In paint and varnish terminology you find such expressions as chalking, peeling, scaling, finking, alligatoring, livering, and flouring. For all these and many other ailments cures have been sought with chemistry and kindred sciences. New uses and new paints are constantly coming out of the crucible.

Tills is the first of a series of articles by Mr. Woolley on what science is doing for industry. Every move science makes, every betterment it brings about in industry, has a definite bearing on your welfare. In this fascinating series Mr. Woolley will point out, one by one, the steps that science has taken in your interest. In his next article bewill relate how science has taken hold of the automobile industry to make your car safer, more efficient, and comfortable for you.

# aist Reduced in 10 Seconds

### ~With New Self-Massaging Belt!

Stop dieting and starving yourself stop tiresome, monotonous, fatiguing exercise—stop paying money to expensive messeurs. By means of a wonderful new scientific, self-massaging belt you can make your waist thinner AT ONCE. Sand coupon below for full particulars.

TO need now for any man to carry around a large, protruding abdomen. Not only does it mar your appearance—not only does it make you look years older than you really are—but it actually impairs your bealth, and thus ruins your chance for success and happiness.

Through a wonderful new invention, thousands of men have found the one safe, easy and pleasant way to get rid of the excess flesh around their want. They don't need to starve themse ves or go on a diet of any hand-they don't have to take strenuous, heart-straining energiae—and they don't have to pay the exorbitant. fees charged by a professional maintur. Yet they

daily get thenner and thinner they look years younger and they actually improve in health too!

### The Secret Explained

This amazing new discovery is a remarkable new kind of a beir which actually takes off fat in an easy, gentle way let results are remarkable rapid. The moment you put on this new self-massuging belt you feel like a new person! Your want is instantly reduced about 4 to 6 inches—your chest expands—your head and shoulders go back-your carriage becomes firmly erect. And what is even of greater importance, after a few weeks results become permanent!

The Weil Scient fir Reducing Belt as the new evention is called, in the result of wars of careful experimentation and research by experie. It is made of specially prepared and scientifically fitted rubber, and is so constructed that it provides a constant gentle massage to the abdoneo. Every me you move severy time you even breathe-a certain amount of fat is massaged away, and before you know it your girth becomes inches smaller! In many cases reductions of as much as 8 inches have been noted within a few weeks!

And with this rapid reduction of the want a wonderful improvement in health is unmediately noted. Stomach disorders—backar.he constipation shortness of breathall vanuab, as the sagging internal organs are once more brought back to their normal positions.







### DAYS' TRIAL SEND NO MONEY

We don't want a single penny unless the Weil Scientific Belt convences you that it will quickly and easily help you to reduce your walst just as it has thousands of others. So we are willing to let you try the belt for 10 dave at our risk.

simply send the coupon below and full particulars will come by return mad. If you write at once, you can also get in on our new Special Reduced Price Offer being made for a smarted time. Mail compan 103345 to The Weil Company, 100 Hill Street, New Haven, Conn.

The West Company			
Continue Team to Continue Team to the description of N and also your Moretal S	ed one, and he will be sen	er whitewards	tag Bargin
Name		+ 41	4646
Address			
CHY	pr 1	Hate	
1 /2 -	or Penther Marks never of the most five goods on the Proper action The best stockled to each a time to off degree 1, each to the best five time the best	distinction of the second of t	The beautiful of the control of the
	The contract of the		

ror tou-Mr. Sign Paintel



JOHO F. MANN, DARR BREZHYNEW AVERNE, WHICAGO, N.L.

### How to judge tobacco

The true test lies inside the pipe—not in the pedigree, says Mr. Krob

In the following letter Mr. Krob points out that once we are past the infantile stage of "taking the watch apart to see what makes it run," we learn that true happiness is a matter of appreciation rather than of analysis. How do you feel about It?

Lorsie, Oklo

Lurus & Brother Company. Rubmond ba. Gentlemen

Most people who are buying Better Light cook up at the fixtures we would not even be interested in the fixtures. They should look down at their factors. desk-top or counter or work bench where they actually use the list. They always want to consider it. 3 O.B." the high might are, instead of Delivered to the to hing place where it is to be atthird.

Personally that a the way I look at t diam in Many manufacturers go into deto telling its where their product is raised. is with a highest him to not it is agent and it wishelf it a parked and place this of e-pear on before the public in their adver-

Who should we care whether tobacco a raised in the Sastina or in an incherg. whether it is a blend of "37 Varieties" or not of the owner of thether it much particle in a creater of a creater of a creater of the may it that a creater of the may it that a creater of the pipe. That a company it that a creater of the pipe. Lageworth

Sincerely yours. K. M. Krob.



As the producers of Edgeworth we are of course vitally interested in its podigree. We are absorbed in the blend of Edgeworth and in its cur-

> ing - in every detail of its development.

> But all our work and experiment and study has but one object—that Edgeworth may prove its worth "Denyered Pipe "

And that's all we expect you to be interested in.

Let us send you free samples of Edgewarth so that you may put it to the one and only test that counts. If you like it, so much the better for us both. If you don't-well, that's that'

Write your name and address to Larus & Brother Company, 59 South 21st Street, Richmond, Va.

To Reiail Tobacco Merchania: If your jobber cannot supply you with Edgeworth Larus & Brother Company will gladly send you prepaid by parcel post a one- or two-dozen carton of any size of Edgeworth Plur Slice or Rendy-Rubbed for the same, price you would pay the jobber.

### Wonders of the Sea

(Continued from page 37)

the United States, the Middle Atlantic coast, further removed from the influence of the Gulf Stream, knows variable temperatures and cold winters.

An equally remarkable phenomenou is the Surgamo Sea in the center of the North Atlantic. This is an area of still water neveral hundred thousand square miles in extent, filled with a seaweed called sargassum, known also as the gulf weed. This weed is believed to grow on the distant aborm and to be carried to the Sargason Sea by ocean rivers such as the Gulf Stream. There are at least four other similar, though smaller, bodies of still water in the Pacific and Indian occurso.

This probably will suffice to give a superficial picture of the physical characteristics of the sea. The real wonders of the see are far beneath its depths, for the see contains much more life, both animal and vegetable, then is present elsewhere on the globe. These specimens of marine dwellers are of exotic forms and colorings and of weird physical characteristics such as are powered by no animal or plant of the land and no bird of the aur.

STRANGELY enough, though, the queer denisens of the deep are behered by scientists to pomess a kinship with the animals of the land, even including man. Chemical analysis of sea water shows that in the salts it contains it is remarkably similar in composition to human blood. From this fact the theory has been advanced that all life had its origin in the sea; that the salt water which the early see dwellers carried in their bodies when they took to the land has been passed along as blood from generation to generation through all the evolutionary changes that have taken place to produce the higher forms of life.

This, however-assuming that the theory is correct—is about the only relic that man and the other animals of the land have taken from the sea, for none of them has the physical capability of supporting life beneath the surface of the ocean. It is not so much a matter of obtaining air to breathe, for science might supply the means of obtaining that. Divers have descended 200 feet and more into the sea. That they cannot descend further is due to the enormous pressure of the water, caused by its weight. If you have ever tried to "fetch bottom" when diving into a lake or river, you undoubtedly have experienced the effect of that pressure in a slight degree. Your ears have rung; there has seemed to be a crushing weight pressing on your chert.

NOW, the painful, crushing pressure that would be felt 20 feet or so beneath the surface of a shallow inland stream of course is multiplied unmensely at the bottom of the sen. Science has calculated the average pressure at the ocean basin to be about 214 tone to the square inch. In the deeps it is five tons or more to the inch. The effect of that enormous pressure has been demonstrated by many

(Continued on page 129)

### FREE! The Book for Red bloods



Bus man or a mouse. First sheat to the word or sink nto up had the a bind into transe. Use we between encies and thing into happersess or makey. Notody else can recome for you. On its With Musclet' my newest has it is a helpful planely worder the motory of how I became the Physically Parison Man and attained world, will professional embruce prosper ty and family happerses have thousands of my people have are need attaining lives through the conquest of constitution, world-meariness, fear debility and the whole safe horde of physical mental and sexual direct era result agricum agnorance negles, and fully the safe of distance with a safe of outstated with acres of superh camera at the of outstated with acres of superh camera at the office with year hast pall. That a You, Get you a state passing hast pall that a You, Get you a state passing hast send the culture region are well one dame. Then Do all No obligation and no a target with the hook. Just send the culture region are not come dame. The to help defray my man agrosse.

LIONEL STRONGFORT

LIONEL STRONGFORT Physical and Bould Speculies for H. Vours Network, N. J., D. B. A. Dogs. 1480 F ---- FREE BOOK COUPON----

DONEL STRONGFORT, b. S. A.

The back may been the making of a better No.

Name			****	
Screen	Number	+ 1-		
Chr				 State

# IEN!



PICK UP THIS EASY And Get

Here is an amazing easy way for you to make \$5 to \$10 every evening after work. Our wonderful new shirt line comains the most attractive styles in silk, linen, madras, etc., and can be sold 50% cheaper than store prices. We will furnish you a free sample line and tell you exactly what to do to make big money this way. We tell you exactly what to say

Y ou receive your profits in advance -- we deliver and collect. Write at once for free territory offer. No obligation. But act quick. Address Charles Hope, FASHION WEAR SHIRT CO. 1200-20 Juckson St., Dupt. 79 Clocknotti. Obio

### Wonders of the Sea

(Continued from page 128)

interesting experiments performed by oceanographers.

If you were to take an empty bottle, cork it, affix a weight to it and let it down into the sea depths on a line, what do you think would happen to the bottle? When you pulled it up again, you would find the cork driven in by the ocean pressure and the hottle filled with water. If you were to repeat the experiment with a hollow glass ball, this would be crushed, or the pressure of the sea would force water into the globe through imperceptible imperfections in the glass. A block of wood, weighted so that it would sink, then drawn to the surface again, would no longer float after you removed the weight, for the ocean pressure would have forced water into the cavities of the wood, exusing the block to become thoroughly water-logged.

ONCE on an oceanographic voyage, a scientist wrapped a scaled glass tube in cloth, placed it within a copper cylinder, weighted the apparatus, attached a line and threw it overboard. When it was drawn up again, the cylinder was crushed almost fist, as though pounded with a harnmer, and all that was left of the glass tube was a small quantity of powder!

Any watertight vessel thrown into the ocean, reaching a depth where the pressure is too great to be resisted by the material of which it is composed will give way by what is called "implosion," a hursting inward, the apposite of explosion, which is a bursting outward. Even a fishof the upper strata of the sea, descending below its accustomed pressure level, would be kitted by implemen. On the other hand, a fish from the bottom, constituted to live in a region of great pressure, actually would explode, if it should swim too close to the surface, due to the expansion of the gases in its internal organs from the reduced pressure

That there can be animal life in the deep-sea areas of enermous pressure is due to the fact that the hod es or the creatures inhabiting them are porous and so theroughly filled with water that the great pressure la not felt.

MANY of the deep-sea animals re-semble plants in their structure. they are exquisitely formed, and delientery colored. Their bodies consist of slim, graceful "stems" surmounted by objects that seem to be full-blooming flowers. But these forms of life are not plants, but animals: for there is no vegetation at all in the depths of the sea.

Then there are crustaceans and spiderlike creatures innumerable, and amazing fish that seem to consist mostly of eyes and mouths. All of these creatures may he said to live solely by eating one another, for the quantity of food that falls to them from above in the form of carcasses of upper-sea animals is small. This eaplains the huge mouths and sharp teeth of the deep-sex fishes; few opportunities to feed come to them, so they must get all the food possible when chance presents.

Nature has further aided them in solving the problem of existence by pro-

(Continued on page 130)





### World Storage "B" Battery (all Change on WOLTS) may with Earlie Face and

he is revising a face to easy of of the constraint and good and an in the reason of the constraint and the constraint of the constraint of

A Superior Battery Solid Rubber Case Hap been system y 1 - 4 in 12 in 11 in 12 in 13 die 12 deutsche mit deutsche Affinen in der Steine mit deutsche Affinen der Steine mit deutsche Affinen der Steine des Steine Mittel deutsche Affinen der Steine der Steine

### SEND NO MONEY

Just reary propher of highering repeated and my will also prove to recovered \$.575.6. ISPAC I backgrown to serve in the part of the little state of the part of th

WORLD BATTERY COMPANY Balays of the forms Borld Station of Strongs Stations 12(9 S. Wahnsh Ave., Dept. 85), Chicago, Ill.

BAVE \$1.00 BT ORDERING NOW!



### U. S. Government Needs Men!

WONDERFUL opportunities in CIVIL SERVICE, Thousands of him and winners appointed givery year as income Tan Auditons, Bookkerpers, Railway Mail Clerks, Pintines, Deputy Conscious ric tenerous painties, short hours, sibera vacations. Postations of the Waddingram gas in every of left town of the outst years we as in Pieto Rico, Assaka. Hawan and he Philippines. Write for 48 lags FREE Bright on givil NERV CE, which to be you how you can get a good-paying position with the Convergement.

Mail the Coupon Tu-day

գ <b>ը</b> , Բե առուգե, հիշտ - անձեցին որ, ին 4 թ	cend nia
4 sour Fly >	APMALL R
	indifference on the end of the second of the second of the end of



EARLE & LIEDERMAN

### If You Had a Face Like a Monkey

you would try to change it. But joint became you beaut a great at passed and a coast at capes the sixt of passed that a coast at capes the sixt of passed that a coast to capes the sixt of passed that it is not to the beautiful to cape at the sixt of the cape is not at the cape it is not to the cape it is not to the passed to the cape it is not to the

### I MAKE STRONG MEN

Not one there to hack at a marrow shouldered that rheated dysqueptly but he is not the good of he well of any our reasons by the standard point enem from the standard enem is not be standard enem in the factor of the standard enem in the standard because where you find see in a death for a body with a standard to be a body with a standard to be standard to standard to be standar

### I CAN DO IT

Just bergang a man in built the an or desent mean be, an above tool how as he the same way. There are dears of stering mean codes who monidate sets you have book ever that I handle my report of teaching that being others. And my aggest as his extraction have as in many desting the best a at part has reach upon My instructions are in sheet and no teachers. When you came one have set in the amounted. I then a presence streetight I passenated in the content of the set of

#### Send for my new \$1-page book "MUSCULAR DEVELOPMENT" IT IS PRICE

It will show you what I have done for effects and what I prepares to do dot you. I have age for these full page their of nibbs of myself and more of sor many period what in the age for pick whiteless present we please to me to help rivers. I not look a chempone and a me do period we please mander on with parties at their tiplerable plays use. This beak will per so on imperiod after the ability plays use. This beak will per so on imperiod ability on the outlet a result in a neglection of a result in the ability of the period of waying the distribution of the look is the period of the ability of the a

	EAR	LE E. LIED	FKWKWM
_	0.440	THE STREET	Show Week C

	305 Synakusy,	Tork City
FARI	 ACRES MAN	

Dept. 1300,	Mil Brandway, New York GRy	
Dear St.	I enchan here with The feet which you a	J
S.A	market and a second company of the second se	~

a cupy of your latest book. Muscular Developme	urt.
Name	
Street samerers secondary	
City	***

### Wonders of the Sea

(Continued from page 129)

viding them with highly elastic bodies This permuts them often to swallow creatures almost of their own size. Their eyes may seem a useless gift, since they live in a region where no sunlight can penetrate. It happens, though, that some of them carry their own headlights, for they produce phosphorescent light that probably suffices to illuminate their prey. Their luminescent glow, of course, probably makes them visible to other preving creatures, and this results in their destruction; but thus Nature contrives to maintain a balance even in the sea.

The vast majority of the deep-eea creatures, however, are nightless — at least that is indicated by the specimens that have been ecooped up by scientists. They find their food by means of their antennas or "feelers," or through some estass thin to feeling or smell.

PROBABLY you are familiar with the animal life of the upper waters of the sea. There are mammals, such as whales, wal, and walruses, and-fish. The latter exist in almost infinite variety. It would be futile to attempt to describe even a few.

Along the shores are other forms of sea life—the clams, system, crabs, lobsters, mumels, and shrimps we use for food: the worms, starfish, sen urchins, and sponges; the corais, the sea-anemones. All of these, no matter what their form, are enimals,

The vegetation of the sea consists entirely of the great floating meadows of seaweed, the grass that grows near the shores, the moss that covers the rocks. This, though, plays an important part in the great scheme of the sea, supplying food for some of the sea animals and liberating oxygen into the water so that the crustaceans and fishes may live.

Once, of course, there was no sea-When our earth was formed, the hydrogen and exygen, the combination of which forms water, were held in its hot crust. As the earth cooled, the hydrogen and oxygen were liberated, combining into water, and the water filled up the great hollows in the earth's surface.

SO CAME the sea to help make the earth more livable for man who was yet to come. For the sea below distribute the heat of the man, yet by the circulation of the fry waters of the polar regions prevents the sun from baking the earth.

It aids agriculture and purifies the air we breathe by the admirable cycle through which its waters pass in their evaporation, and later precipitation as rain,

It distributes the dust of the earth, for it is the beginning and end of all streams that pass through the land.

It yields man a rich harvest in food, and unites the distant dwelling places of the different races of men.

It is an unending wonder to the curious, a perpetual challenge to the daring, an everlasting inspiration to all men.

Next mouth Mr. Brown will tell of the wonders of earth's minerals—marveis of nature upon whose use all human progress is founded.



### FORD RUNS **57 MILES ON** GAL of "GAS"

An automobile runs \$7 miles on a gallon of gasoline by using an automatic device. which was installed in less than five minutes. The inventor, Mr. John A. Stransky, 14-1st St., Pultwans, S. Dak., wants agents and is willing to send samples at his own risk. Write him today.



quab Book FREE

Squabs selling at highest priors ever known. Greatest market for 10 years. Make money breeding them. Raised to one month. We ship everywhere our famous breeding stock nd supplies. Estate shed 33 years, Write now for his flust stad free book, Here to Make 1 ones fitteding figuals. PLYMOUTH BOOK Byune And Marie And Marie Ma

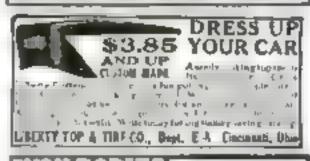
### AGENTS 500% PROFIT GENUINE GOLD LEAF LETTERS

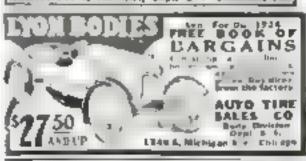
Guaranteed to never turnish. Anyone can put forth on stores and office to shows. Endeth and demand large at the P of tark as a sone test day \$28.70 R 1 Rect made 19 to the two mon he Walter piles for free patople and oberat offer to gracial agenta,

METALLIC LETTER CO. GIAR San Smel, Chipp.











### How Chemistry Is Feeding Us

(Continued from page 45)

Dehydration of fruits and vegetables the removal of nearly all moisture with the least damage to the product—has made rapid advances, but here improvements are still needed and are coming along. The goal is to produce dried fruits and vegetables, which, after they are soaked in water, will be almost as good as when fresh

The bread bakers, too, have a great institute of research in Chicago, besides private laboratories and fellowships at the Mellon Institute and elsewhere. Their purpose is to make bread a more complete ration so that we, the general public, may find ourselves more satisfied with this cheapest of foods, and consequently will

eat more bread and less meat.

The improved bread uses up the summer milk of the dairy farmers who have been lacking a market for it heretofore. The milk is dried and worked into the bread, giving it many of the qualities for which we cat meat. There is three or four times as much milk in bread now than there was five years ago. Using more wheat by atimulating greater sales of bread, and using more milk to encourage the sales, is profitable to the farmers and economical to the consumers.

Even in the fields, science protects the crops that feed us. Insect pests may destroy a whole civilization, and the battle against them must be incessant. If it had not been for American entomologists and chemists, the fruit crops of this country would have become negligible.

IN THE study of foods, research is proceeding also along the line of maintenance of health. It has been found that unless minute quantities of certain singless called vitamines are present in food, various diseases, such as beriberl, scurvy, certain eye troubles, and

The chemical structure of vitamines in atill unknown, although it is possible to separate them into four different kinds and to get rather concentrated aggregations of them. Three have been known for some time, and lately Dr. W. H. Eddy, of Columbia University, has found a fourth. Scurvy and beri-berl, both distressing, and formerly fatal discusses, have been practically eliminated by the discovery of the necessary vitamines in milk, green vegetables, rice hasks, citrus lysits, tomatoes and other substances.

As to the requirements of the body for minerals such as time, iron, potash, and the like, we know now at least how much of these substances should be included in a month a ration of food. It has been found that litness usually follows deficiency in one or another of these minerals. Gotter, for example, follows a deficiency in loding in food or drinking water. Grawing children with growing bones need more lime than their elders.

And so we go on, trying to do the useful things and seeking always to understand a little better than before. Science doesn't move shead with a brass band, with trumpets and drums. No; its progress results from hard, slow work, with here and there a happy reward.



Sears Rochasck and No.

The Monte Cargos State Course and appears to an a Mill of Section profit theory of the page.



### MAKE MONEY-SELL RADIO!

Radio offers the biggest mosey-making opportunity on earth today. And the Osarke Flur opera the door to this big opportunity. In k at the making was his edison and Radio Receiver. The actuse was his edison and set all offers a single was his edison and that that Radio Instrument can be the or source of our own making was its same to arise sureing by will be a new a sec to arise and to responsible toward the case plobbs.

To experience necessary. It is need not have in a cash. All a need a space time term nation are as and if we are take in a fact to the Oracles Plance Western in a sea of the cash of a sea time to ward a real more making between his are sean. It can be a left an an probabile as you are ambetions to make it. We want good men in every mount; the cluster territory is point fact. Be sure and give as the name of poor county. Welle to-day for the Otacka Plan. A winderfully interesting book of facts, particulars and proofs. It is FREE, Act now.

OZARKA, INC.

BOOK

### REPAIR THAT CRACKEDS BOILER SECTION YOURSELF!

ents' worth of Smooth-On No. I and you'll get a perfect permanent report without putting anything harmful inside the boiler and without having a big plumber a bill.



Smooth-On No. 1 affords the simple, quick, sure means for stopping leaks to boilers, radiators, furnaces, water pipes and tanks, stove pipes, kitchen pails, etc., and can be used for hundreds of other house and automobile repairs.

The book we send free tells you how to use it and some can get your suppley in deat. 1-th S-th or 1th th. Irus from any like dealer

SHOOTH-ON REPAIR BOOK

· Free:

SMOOTH-ON MFG. CO.

Dept 54

574 Communipaw Avenue,

Jersey City, N J

### MECHANICS' HANDBOOK



### 330 PAGES More than 300,000 sold

HANDIEST book of its Only pared by experts under the direction of the Internstional Correspondence Schools, Written in language that you can understand. Note this partial list of aubjects



Weights and Messures; Eastly Underateed Mathematics, Formulae; Measuretion; Balting; Hydro-mechanics; Strongth al Materials, Holler Design; Care and Inspection of Bollers; Horsepower of Bollers; Chimneys; Enhaust Heating; Machine Design; Heraspower of Engines; Betters and Pumps; The Slide Valver Bult Pulleyer Rope Beiting: Cylinders and Steam, Chesta; Electricity; Currents; Wiring, Dynamos and Maters; Batteries; Cable Testing: Compass Surveying: Curves; Leveling; Etc.

Just mail this advert sement with a dollar bill and your name and address, and this \$50-page 1. C S. Mechanics Handbook or any of the other L C & Handbooks that you want will come to you by return mail.

#### INTERNATIONAL CORRESPONDENCE Bur Phili-D. Brenden, Print.

I sprices 8 for which could me, portpoid, the Hamiltonian marked X, at 8 44 each. It is understand that '? I up not rid rid out of the limit from the limit for days and get the mark the days and get the mark the days and get the money back.

Abbonobile Candbon

Electrical Pabilitatic

Same of Handbook

Characterist Pabilitatic

Characte

Address



PRESS CO. . Commission, Co.

### Here Are Correct Answers to Questions on Page 64

Because when you go uphill you are lifting your weight against the force of gravity. This takes power. When you go down, the force of gravity is with you.

2. They are substances present in very small amounts in many foods and that seem to be necessary to health. Their exact chemical nature is not understood. nor do we know the precise way in which they set on the body. If your usual diet meludes meat, milk, butter, and fresh vegetables, you will get enough vitamines.

3. When men first began to study the stars, it seemed that the stars marked out figures in the sky. The ancient Baby-lonian astronomers, thousands of years ago, gave names to these figures and used them as a convenient way of referring to certain stars. Later on this system was borrowed by the Persian and Arabian astronomers and came from them to us.

4. If there were any air inside the bulb, the bot tungsten in the filament would combine with the oxygen of the air and burn up.

5. Science believes that it cannot. Energy is merely changed. Electric energy in a wire may disappear as electricity, but the same amount of energy appears as heat.

6. Because he is in the habit of feeding on the leaves at the top of trees. In the course of millions of years he and his ancestors have developed a longer and lunger neck so that they could reach high trees

7. The waves of sound in the air strike against something hard and smooth, like a wall or the side of a cliff, and are reflected back again, much as light waves are reflected when they strike a mirror

8. 5,885,516,000,000,000,000,000 tons. To get some idea of what this means, think of a tiny dust mote in a beam of sunlight and compare the weight of this with the steamer Levislan. The earth is as much heavier than the Levislan as the Levisthan is heavier than the dust mote.

9. It is a stream of electrons rushing through a wire like a stream of people in a tunnel. Through the filament of an orde nary 60-watt electric lamp there pass every second so many electrons that if all the people in New York City were set to counting them and if they counted two a second without stopping for 10,000 years, they would still have a few to count.

10. No. They are far too small. It takes more than a hundred million hydrogen atoms laid side by side to make up ooo inch. The other kinds of atoms are only a little larger than this.

11. Radium. It is worth nearly \$2,000,000 an ounce. Of the ordinary commercial metals, tridium, the metal used for fountain-pen tips, brings the bighest price, about \$250 an ounce.

12. There are a great many things that happen in our nervous system of which we are conscious only indirectly. For instance, when the stomach is empty and several hours have passed since the last meal, the nerves in the stomach lining send messages to perve centers in the stone and in the back part of the brain and announce that the digestion of the last meal has been completed and that another one can be sent along. The lower nerve centers translate this message into Dun gez

Nor Of you Laidge says he homes this discovery will not become generally known until manking has sufficient wiedom to handle the power that it will loosen. But scientists have already tapped this source of power! Not yet harroased perhaps but yet plaid enough that ANY AVERALE PERSON can to a large extent demanates to it in daily life.

With the can of this ENFRGY you can securebulk anything humanly prosible. This FACT has been proven by the actual superiorer of thousands of people during the last twelve months in whose hands we truly placed this amazing discovery. You not only "gut the idea" but it applies itself to your affairs within a few days.

#### NOTHING IMPOSSIBLE

Liturally thousands of people changed their lives almost oversight by this revolution.

With this secret Cal. Adams of Salt Labo

Unless this power will immediately and practically WORK for you, unless you can demonstrate it so clearly on a child demonstrates electricity by terming on the clearly light, IT IS WORTH NOTHING TO YOU. For all manary not equal, Doubt, feer, empicion, distruct, presolution are character make slaves of many

#### SEND NO MONEY-JUST THE COUPON

When the cropped below and mail at once. When the Loughete Course reaches you amply pay the postures only \$2.55 10.000 others have poid up to \$25.00 for these same wonderful instructions. But the sample prescripts in work immediately and if eiter five days, you deade that the remarkable course to se valuable to you as to others, heap the complete instructions for regular up. If not fully establed simply return the Course and we will think your managest once.

CARNAGEY INSTITUTE. 603 Hayes Blidg , Kansse City, Mo

Send me the Complete Instructions, "Making Men Think Your Way." I will pay the post-man \$2.83 on arrival and premise to try the Course five days.

\* \*\*\*\*\* \*\*\*\*\*\* \*\*

NAME

(If you expect to be out when postman calls, and money wider at check with this enupon.)





### Build a Super-Heterodyne

Continued from page 69)

adjustment. The stationary plates are marked A, and the rotery plates, B.

Number 5 is the A-battery switch, No. 7 the rheostat controlling the oscillator tube, and No. 20 the rheostat controlling the first detector tube.

Number 8 is a .002 microlared fixed condenser

Number 9 is the negative B-battery terminal: No. 10 the oscillator tube socket, and No. 19 the first detector tube socket.

Number 11 is the honeycomb-cod mounting used when a coil is required, for use with aerial and ground. Only the terminals are shown on the rear of panel.

Number 12 in the positive B-battery terminal of the oscillator circuit. The positive B-battery connection is made through the amplifier units connected with this first unit.

NUMBER 13 is the pick-up coil through which the oscillator wave is impressed on the grid circuit of the first detector tube.

Number 14 is the grid soil, and No. 15 the plate coil of the oscillator. The terminals of each coil have been marked A and B. The A or inside end of each coil is the end nearer the center of the coil, while the B or outside end is the end forther from the center

Number 16 is the variable condensed mod to tune the serial circuit. This condenser should be of .0005-microfared especity and should be provided with a Vernier adjuster. The stationary plates terminal is marked A, and the rotary plates terminal, B

Number 17 is a .00028 microfarad grid rondenser, while No. 18 is a fixed grid

leak of two megohims.

Number 2. is the plate terminal, connected with the amplifier unit. From this the connection goes through the primary of the amplifier unit transformer, thence to the B battery

Numbers 22 and 23 are terminals with which the A-battery circuits of the amplifler stages are connected.

TIRN new to the two-stage audio-

Terminal 24 is the input terminal of the amplifier unit; No. 26, the negative A-battery terminal; No. 26 the positive A-battery terminal of the amplifier; No. 27 the tube socket of the first audio-frequency amplifier stage; No. 27 the tube socket of the second audio-frequency amplifier stage. Numbers 28 and 29 are double-circuit jacks. Number 30 is a single-circuit jacks.

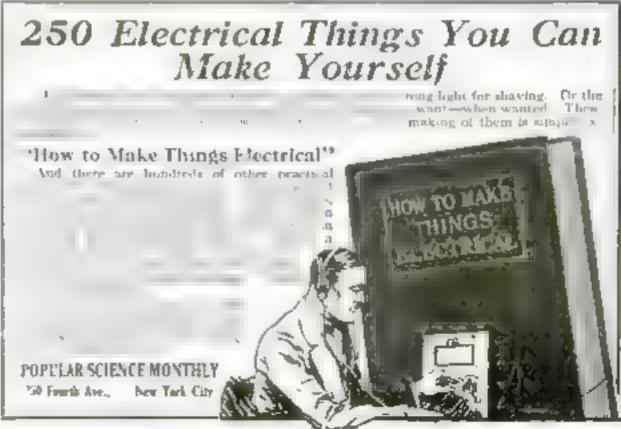
Numbers 31 and 36 are audio-frequency amplifying transformers. If you use another type of transformer, follow wiring directions according to terminal marking

Number 32 is the positive B-battery terminal for the detector stage that is connected before the first stage audiofrequency amplifier.

Number 33 is a standard 41g-volt C battery: No. 34, a one-microforad fixed condenser; No. 35 the rheostat used to control the fi ament current of the two audio-frequency amplifier tubes; No. 38

Continued on page [34)







You may have the talent to develop into a Saxophone wizard like Tom Brown, of the famous Tom Brown's Clown Band, and enjoy this most pleasant of vocations; Buescher Band and Orchestra Instruments have helped make famous such leaders as Paul Whiteman, Jascha Gurewich, Clyde C. Doerr, Bennie Krueger, Ben Selvin, Joseph C. Smith, Dan Russo, Gene Rodemich, Henry Emitrey, Zes Confrey and thousands of others. \$100 to \$500 weekly for a few hours a day is not uncommon for municians of ability to ears.



The Buscher Saxophone is so perfected and almplified that it is the easiest of all musical instruments to learn. It is the one instrument that everyone can play—man or woman, boy or girl—and it wholly estudies that craying everybody has to personally produce music. You can learn the scale in an hour's practice, play popular music in a few weeks and take your place in an Orchestra or Band within 90 days, if you so desire. Nothing can take the piace of a Saxophone for home entertainment, church, lodge or achool. It increases the pleasure you get out of life, increases your popularity and your opportunities.

### FREE Saxophone Book

Six days' free trial and easy terms of payment arranged on any Buescher Sanophone, Cornet, Trumpet or other instrument, Just fill out and mail coupon on the right for Free Sanophone Book or Complete Catalog.

B	sescher	Band	Instru	ment	Co.
- 6	permissing to		Oreheave.	1 de la comp	and a
162	Bussch	or Bloc	lg J	Skhar	L Iron

Bosscher Band Instrument Co., 151 Bosscher Hoch, Ethbert, Inc.
I am linerated in the bedrament should below:
Bezophone Chrost. Trembers. Trempet
Home
D. Address

### How to Build a Super-Heterodyne

Continued from page 133;

the positive B-battery terminal of the audio-frequency stages.

The wiring of the receiver is simple.

First, begin wiring the oscillator and first detector unit. Practically all leads terminate at the filament circuit, so it is best to wire the filament circuit first. Begin by connecting terminal 2 with the A terminal of battery switch 6. Run a wire from the B terminal of switch 6, connecting in turn terminal B of rheostat 7, terminal B of rheostat 20 and terminal 22.

terminal 23 along the baseboard close to the panel. With this wire, join terminal 3, B terminal of fixed condenser 3, P<sub>1</sub> terminal of socket 10, the outside end B of grid coil 14, the outside end B of the pick-up coil 13 of the oscillator assembly, and the P<sub>1</sub> terminal of socket 19. The A terminal of rheostat 7 is connected with the P<sub>2</sub> terminal of socket 10, while the A terminal of rheostat 20 is connected with the P<sub>3</sub> terminal of socket 19.

Next, run a wire connecting the P terminal of socket 10 with the rotary plates terminal B of the oscillator condenser 5. The outside terminal B of plate coil 15 of the oscillator assembly then is connected

with the wire just mentioned.

From terminal 2 run a wire along the back of the panel to a point just over the center of rheostat 20; then bend it out and terminate it at the rotary plates terminal B of the variable condenser 16. The B terminal of the coil mounting 11 and the inside terminal A of the pick-up coil 13 are connected with this.

The inside terminal A of the plate coil is in connected with terminal 12 and with the A terminal of fixed condenser 8.

The stationary plates terminal A of condenser 5 is connected with the G terminal of socket 10. The inside terminal A of the grid coil 14 is then joined to the wire just mentioned

The G terminal of socket IS is connected with the B terminal of grid con-

denser and leak 17 and 18.

Now run a wire connecting in turn, terminal 1, terminal A of the honey-comb-coil mounting, the stationary plates terminal A of the variable condenser 16, and the A terminal of grid condenser and leak 17 and 18.

The wiring of this first unit is completed by connecting the P terminal of

socket 19 with terminal 21.

Now we are ready for the two-stage audio-frequency amplifier unit. Here, also, we can begin by wiring the filament circuits.

First run a wire from terminal 25 to the B terminal of rheostat 35. The positive terminal of the C battery 33 is connected with that wire. Then connect the F, terminals of sockets 27 and 37 and with terminal A of rheostat 35.

Now run a wire from terminal 26, along the back of the panel, to terminal  $F_2$  of socket 37. To this wire are joined the  $F_2$  terminal of socket 27 and the A terminal of condenser 34.

In the double-circuit jack the A and D terminals are the outside terminals or springs. The A terminals of all the jacks are the case meanest the frames. The B

terminal is the inside terminal that makes contact with the A terminal, while the C terminal is the one that makes cont of with the D terminal.

Connect the A terminal of jack 28 with terminal 24; the B terminal of the jack with terminal P of transformer 31; the C terminal with terminal B of transformer 31; the D terminal with terminal 32.

The G terminal of transformer 31 is connected with the G terminal of socket 27; the P terminal of socket 27 with the A terminal of jack 29; the B terminal of the jack with the P terminal of transformer 36; the C terminal of jack 29 with the B terminal of transformer 36; the D terminal of jack 29 with the B terminal of jack 30, and with terminal 38.

The G terminal of transformer 36 then is connected with the G terminal of socket 37. The F terminals of transformers 31 and 36 then are connected with the negative terminal of C battery 38.

The wiring of the amplifier unit is completed by joining the P terminal of socket 37, the B terminal of jack 50, and the B terminal of condenser 34

The completed units now are ready to be used with the intermediate frequency amplifier and second detector unit.

If you complete these two units, you can use them as a three-tube honoycomb-coil non-regenerative receiver. Simply disconnect the pick-up coil 18 from the circuit and connect the rotary plates terminal B of condenser 16 with the positive A-battery lead, which terminates at terminal 4. Then you can use a 25-, 85-, or 50-turn honoycomb-coil in mounting 11 to act as the tuning element.

CONNECT terminal I with an outside serial, and 2 with a good ground.

Connect terminal 24 of the detector unit with terminal 24 of the amplifier unit by a wire on the front of the panel between the two binding posts attached to terminals 21 and 24. Similarly, connect terminal 22 with 25, and 25 with 26. Three last connect the A-battery leads of the amplifier unit with the A-battery leads of the detector and oscillator unit.

Next, connect terminal 5 with the pegative A-battery terminal, terminal 4 with the positive A-battery terminal, and terminal 9 with the negative terminal of the B battery. Since the oscillator stage is not used, terminal 12 is left threonnected.

Terminal 32 serves as the positive Bbattery terminal for the detector stage, and terminal 38 on the positive B-battery terminal for the amphifer stages.

If a soft tube is used as the detector, terminal B should be connected with a B-battery voltage of not more than 2214 volts. If a hard tube is used, terminal 32 may be connected with a plate voltage as high as 6714 volts. Terminal 38 should be connected with a B-battery voltage of about 90 volts.

The voltage of the A battery will depend on the types of tubes used. The oscillator tube socket 10 is not used.

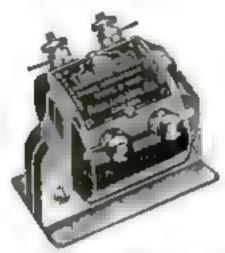
This receiver is very easy to tune, and will enable you to listen to programs until you complete the intermediate frequency amplifier and second detector unit.

# Your Own "Super-"

must function without a fault

### therefore-

# All-American coupling throughout for Reliability!



Long-Wave Radio-Frequency Transformer, 4,000 to 20,000 meters. (Intermediate-Frequency Transformer, Iron-Core Type.)

Known and relied upon everywhere for splendid intermediatefrequency amplification, because of the unique design, which provides maximum amplification at 30 kilocycles as well as at other frequencies in standard use, from 15 to 75 kilocycles (20,000 to 4,000 meters.)

Type R-110

Price \$6.00

#### Air-Core Radio-Frequency Transformer, Tuned Type (Filter or Input Transformer)

Very much of the empired of beat reception depends on the qualities of the filter used. The R-120 instrument is built with the attended acceptant to save an invented late-frequency wave of 13 000 meters (30 kg.) together with the side-halfd treating from modulation support on ately 26 to 34 kide president day a ped out result by in a selectivity which will surprise even the neuronal experimentary

Type R-120

Price, \$6.60



#### Radio-Frequency Coupler, Range 150 - 650 Meters (Oscillator Coupler)

The most critical tests have shown that the use of an All-Asternam couplet makes togashle a und size on put at any ting tency without the range of the anal ament massive troup 150 the era to 650 meters (2000 to 462 k his prices)

Take the Is see R 120 Transformer, this templer is nerviewly forward in a baketite case of practical and steading design being those effectively proceed from all in any by fact, went monture, or easy han call outrage.

Type R-130

CHICAGO

Price, \$5.00

### Audio-Frequency Transformers

In bulking an itype of bugh efficiency receiver it must not be forgonen that all efforts at effect of tone in it, but be of built bless he fibral am fide on most proofs are to able if entirely post is effectively if the formula is. The accumulation the familiar wishs of the two Auditorials transported in a time and of the accumulation of all the same of the accumulation of the accumu

Type R-17 Ratio 3 to 1
Type R-21 Ratio 3 to 1
Type R-30 Push-Pull Input
Type R-31 Push-Pull Output

Type N-31 Push-Pull Output

The new RAPIO RAY BUR K just out 45 pages or the bert alternand reference bood on Radio Reception and Hoth tip a re-published I in an art it by reading 10 cents corn or stamps. I had for it now—the Frest Edition will not last time.

RAULAND MFG. CO., 2667 Coyne St.,



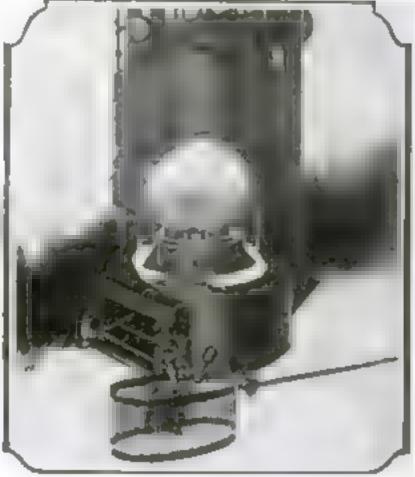


Œ)

AMPLIFYING TRANSFORMERS

Largest Selling Transformers in the World





# A Perfected Oil Burner for Your Furnace State Under Marie \$8950

NO reason for you to pay from \$400 to \$700 for the convenience of a furnace oil burner. For \$89.50 you can now have the famous No. 30-A furnace burner—the greatest triumph of the Oliver engineers—an improved and perfected burner listed as standard by the Underwriters Laboratories. The saving to you is from \$200 to \$500.

Save \$200 to \$500

And when you install an Oliver Burner you have no worry about expensive, delicate machinery getting out of order. There are no noisy motors—no moving parts. You do not have to depend upon electricity or gas for operation.

Vet you have automatic heat, dependable to a degree that was never before experienced — smokeless, sootless, instantly regulated for either coldest Winter, or moderate I all

days. This simple device converts any type or size of steam, hot air or

hot water furnace into an automatic heating plant. Quickly and easily installed without change to your furnace. Absolutely safe—lasts a lifetime.

### 200,000 Installations

200 000 homes have tested Offiver Unioners—
and have burnshed for ever coas as exdirt—smoke—soot—dust—building fires—
cleaning furnaces—frozen pipes—exorbitant
fuel prices—uneven heat—cold rooms, So
great has been the saturfaction of actual users
that Offiver Burners are sold on an extraordinary guarantee of complete satisfaction

### FREE BOOK-Mail Coupon

There is an Oliver Burner for your home, for all types of heating stoven and cook stoves, as well as furnaces. At this arraseingly low price you cannot afford to put up longer with the health dangers, the dirt, and inconveniences of coal or wood. An interesting book, giving full details, will be sept you free, upon request Simply fill out and mail the coupon below. Get it in the first mail

### Distributors

Never before has an opportunity for such substantial profits existed in this field. An \$89 50 furnace burner that is a marvel of mechanical perfection means that every home owner is an interisted prospect. Our representatives, whose carongs have always been big have than their incomes suduenly usualed and tripled.

Our business has grown to sac's a volume that we must now have represents us an every section of the linked Stalls. We are appointing as I sciasive Distributors for counties and sections, business men of the very highest type as a sine—turning over to them our established business, and in many cases already organized sales forces.

Only those who act quickly will eash in on this wonderful opportunity. At the present time a proposition can be outlined to you entirely commensurate with your ability in present position. Write or wire at once for full details, addressing Sales Manager. We also need dealers, sales agents and source time workers. Many earn \$100 to \$250 a week. Send immediately for sales plan.



Any degree of bear desired, off and on at turn of valve. Excellent for year round heating. No odor no wicks. Absolately sufe.

### lutely safe.

954 OLIVER BUILDING, ST. LOUIS, MO.

Others and Largest Manufacturers of Oll-Gos Burners in the World CANADIAN DISTRIBUTOR: 954 OLIVER BUILDING, TORONTO, ONT.

OLIVER OIL-G 18 BURNER Co., 154 Oliver Bidg., St. Louis, Mo.

Pierse and me at more your free book and full details on 1 Furnace Burner a work Store Burner, Heating Store Burner

Name.

Address

City

State



# Popular Science Monthly

Most Wonderfully Illustrated Magazine in the World

OCTOBER, 1924; Vol. 105, No. 4 25 cents a Copy; \$2.50 a Year



Published in New York City at 250 Fourth Avenue

### Coming Next Month

What is your radio problem?—Broadcasting is passing rapidly from the realm of the enthusiast to that of the public service utility, such as the telephone. Yet, unlike the telephone, radio has not yet been standardized to the point where you can use any receiver at any time, or any place, and expect to hear messages satisfactorily.

The wide choice of receiving sets and hookups available, varying widely in cost, operation, and results for different localities, has brought about a serious problem for every person who is eager for the best that

radio offers within his means.

To help you solve your individual radio problem and to keep you abreast of radio progress—these are the main purposes of POPULAR SCIENCE MONTHLY'S enlarged Radio Section, the most complete and

useful of its kind published in any magazine.

In this section next month, for example, an expert of the POPULAR SCIENCE INSTITUTE OF STANDARDS will tell you how to choose the set within your means that will give you the best service in your locality. Milton B. Sleeper, one of America's foremost radio engineers, will describe how you can build a short-wave receiver to pick up short-wave transmission that cannot be heard with the ordinary receiver. Jack Binns will give you all the up-to-the-minute radio news.

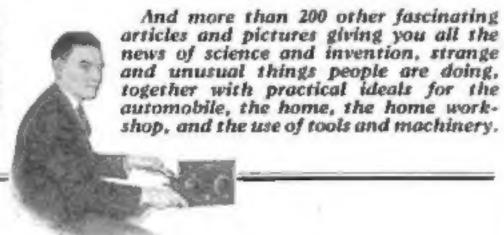
An understandable article on the A-B-C's of broadcasting and reception, scores of useful hints for everybody, and many practical construction articles, round out a useful radio service such as you cannot

get anywhere else.

Are you deaf, and don't know it? Do you realize that one out of every 10 persons in the world suffers defective hearing in one or both ears? Simple ways to test your hearing, and to safeguard yourself against the tragedy of deafness will be told by a distinguished authority.

The magic stuff called electricity.—What it will do for you, and what science is doing to enlarge its powers as your servant. Edward Mott Woolley's remarkable story of a tremendous laboratory where men are harnessing its mysterious forces for the benefit of mankind.

Milton B.
Sleeper, dietinguished
American radio
engineer, who
will describe in
next month's
issue how to
build a shortways receiver



### POPULAR SCIENCE MONTHLY

Immed monthly. Single copy, 25 cents. Yaurly subscription in United States, its processors, and Canada, \$2.50; turning atministra, \$3. Entered as according matter Dec. 28, 1918, at the Post toffice at New York under the per of March A. 1879. Entered as second-class matter at the Post Office Department, Canada, Printed in U. S. A. Cuppright, 1924, by the Popular Science Publishing Co., Inc.

The contracts of this magnifies must not be reprinted without paratition. In presenting in its editorial columns nonzerous studies of new products of applied science. Postular Science Montreet deep and underwriter the business methods of the individuals or concrete penducing them. The use of Postular Science Montreet or ordicles, or quotations from them for stock-selling schemes is never antiserized.

H. J. Fisher, President R. C. Wilson, Vice President C. B. Capen, Science and Tectures.

### In This Issue

Page Page
The Popular Science Institute of Standards
The World's Greatest Adventure M. By May, William N. Hender, Jr., U.S.A.
A New Bra in Automobile Construction 35 By Reward Most W sley
Why the Pastest Rocchespen Louis
By Stanley G. Zinke, M. D. Rebuilding the Portal that Muses
Are There Twins in Your Family? 41
By H. H. Newman, Ph.D.
fly Donald A. Land, Ph. D.
The Must Amurate Man in America. 44
Stilled Mechanics in Congress 46 He Photographs the Invisible 47
New Wonders in Giant Twin Biar 49
Why Apimala Understand Me. 50
New Uses for Photo Telegraphy 52 By Newton Bucks
Keestone Abreaut of Societies 13
The Largest Floating Drydock 53 By S. W. Claimerthy
Lights as an Aid to Happiness 56 By M. Luckleyh
World's Smallest Plane Mooring Mast Supplies Helium, 58
I misse-ith-radio beath Litting.
Map Made from 2000 Photos 39
of the state of th
Bangalor Market Ser. 50
The state of the s
Fasta Wagon from Chi Anto 61
Prince of Suntining Wheels.
A Modern North's Ach
How a Queen Bee Travela. 63 Four Roors' Sunshine in Alaska. 63
Alestory vyle on Power Plant 63
Pastorm for Unloading Grain 64 Four Drawing Instruments in One 64
Sa-Juch Side Rafe 04
Fusicating Vault for Furniture 05
An Automatic Grand Luck 63
New Milegeons in Radig
By Just Blans
How to Build a Super-Reterodyne 08 Coast-to-Coast Set for \$13,25
By L. Grant Hector, Ph.D. Radio Mists for the Broadcast Phys. 70
How Broadcasting Works 71
By Robert E. Martea Small Crane for Truck Wheels
New Sea-Wheel Army Truck 72
Partable Truck Scales 73 New French Small Car 73
Brooklyn Has Largert Generator 74
Bracklaring Made Basy 74 A Upeful Folding Ladder 74 Oil Refinery on Railway Cars 75 Vandacts for Traffic Reflief 75 Traveling Laws Sprinkler 75 Stories Revealed by Earth Strata 76
Oil Refinery on Railway Curs 75
Varducts for Trathe Relief
Traveling Laws Sprinkler 75 Stories Revealed by Fasth Strate 76 Deaf Children Taught by Radio 76
Deaf Children Taught by Radio 76
LARBERTHIE IN COC SWING LITTLE A 70
Glass Traffic Light Brake Tessing Instrument
Treeless Spots in the Parest
Collapsible Scissors 78
Sewing Machine Calonet 78 How Much Science Do You Know? 78
New Freight Handling System 70
Vest Porket Brush 79
Know Your Car
Save your Wife 19,000 Steps a Day 21 By L. Porter Moore
Keeping Your Car Free of Carbon 63
Ideas that Cut Garage Dills \$4

And other timely articles and pictures

Congression I make

#### POPULAR SCIENCE MONTHLY

# The PAUL REVERE of TODAY

WENTY miles in a single night. That was the wonderful broadcasting achievement of Paul Revere as he galloped from village to village, wak-ing the country-side with the cry, "the British

Just one hundred and fifty years ago he made that broadcasting record. Today news flashed in any part of the country is heard almost instantly, not a mere twenty miles, but thousands of miles away.

In every part of the United States Crosley Radio Receivers are bringing in far distant stations clearly and distinctly. Up to the minute news, concerts, music, lectures, are yours to enjoy right in your home when and from where you choose if you own a Crosley.

Keeping always at the head of the procession in improvements and innovations, the Crosley Radio Corporation has made it possible for every one to possess the maximum efficiency in radio reception at the minimum cost. The Crosley Trirdyn JRJ illustrated below is, in the opinion of many experts, the best radio receiver ever offered to the public at any price. The experiments of over 200 experts have shown that in case of tuning, sharpness of signals and nicety of calibration, the Trirdyn cannot be excelled. Local stations may be easily tuned out, even if very close to you, and far distant reception almost instantly brought in,

The Trirdyn 3R3, illustrated below, is a 3-tube set incorporating tuned radio frequency amplification, re generation and reflex. It has been proven to give the efficiency of most 4 or 5 tube sets. And yet it is priced at on y \$65 without batteries, tubes and headphones. The Trirdyn Special, set in a special solid mahogany cabinet which is made to house all necessary accessories, may be had for only \$75.

Before you purchase a radio receiver listen in on a Cresley. Trirdyn.

### For Sale By Good Dealers Everywhere



Crosley Trirdyn 3R3, \$65.00

#### Other Crosley Models

Crealey 60. A one tube Armstrong Regenerative Receiver. Price. hers accessories, \$14,30. A two stage amplifier, Crosley 50-A, may be added to it for only \$18,00, thus making a three tube set.

Creeley \$1. The two tube Armstrong Regenerative set that became the biggest seiting receiver in the world in just 24 days. Price, less necessories, \$18.50. By adding the Creeley \$1.A a one stage amplifier at \$14.00, a three tube set may be formed.

Crosley 60-F. The Crosley 50 in most strong Portable quartered oak cabinet for only \$10.00.

Crosley \$1-P. The Crudey \$1 in compact leatherette portable care completely self-containing at \$25.00.

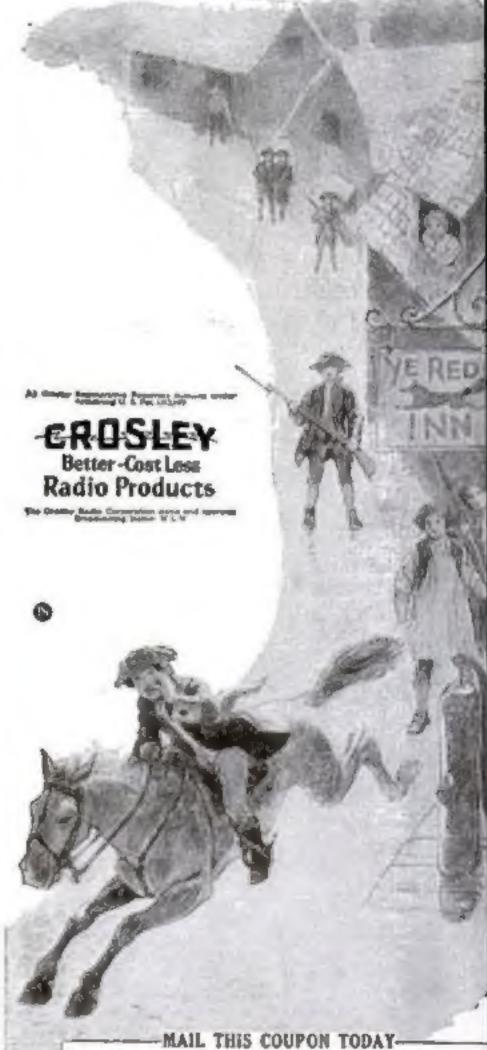
Crosley 52. A new Armstrong Regenerative 3-tube set assuring loud speaker volume on distant stations under almost any conditions, Price, without accessories, \$30.00. Creeley X-J. One of the best known and most popular 4-tube receivers on the market. A radio frequency set at \$35,00 without

accessories. Conslaw M. beautiful makegany console cubinet. Price, without accessories,

### THE CROSLEY RADIO CORPORATION Powel Crosley, Jr., President

1017 Alfred Street

Cincinnati, O.



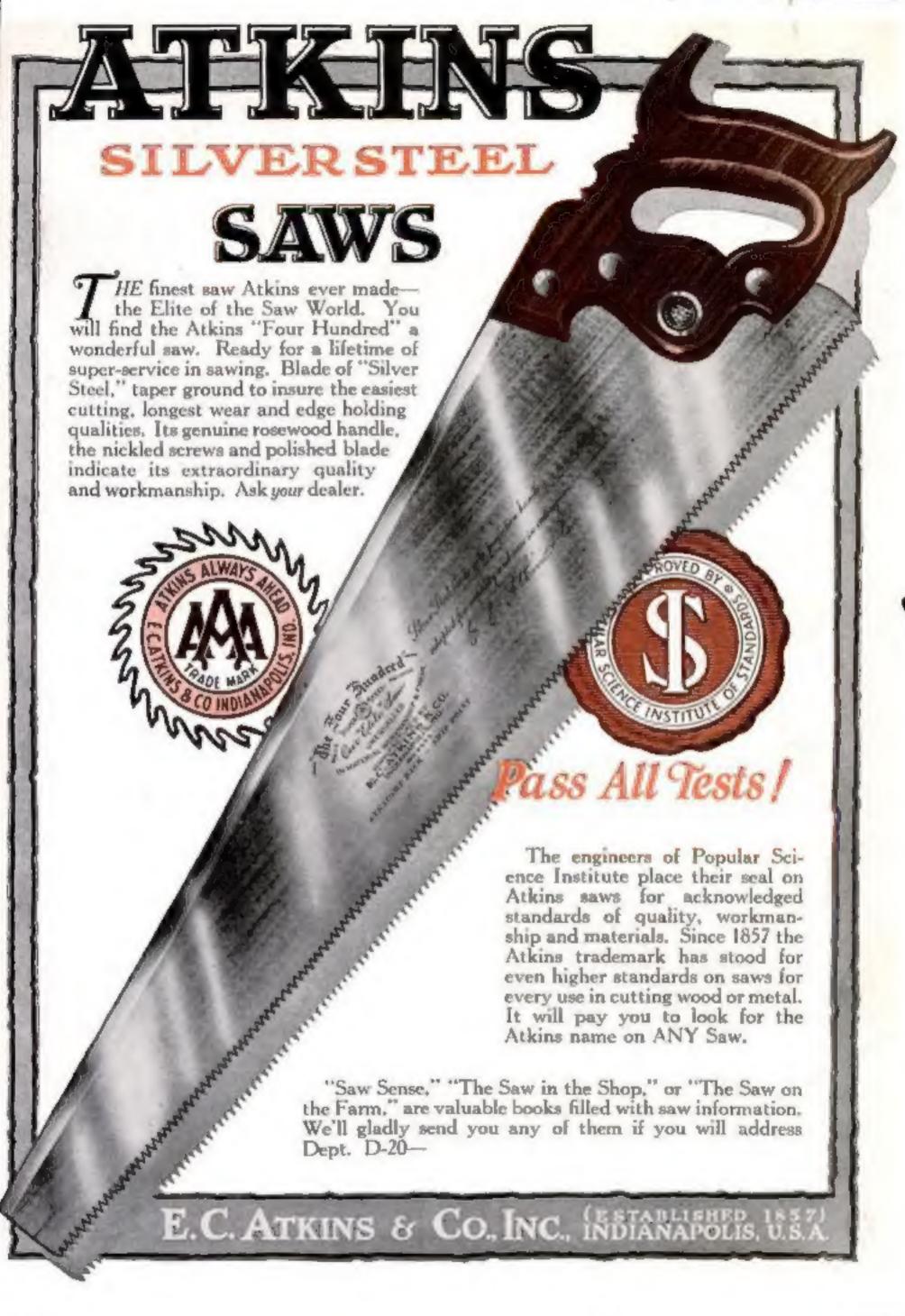
The Coulsy Radio Corporation,

1017 Alfred St., Cincinnet, O.

Genelement: Please mail me free of charge your complete catalog of Createy institutions and purts together with booklet entitled "The Simplicity of Radio".

Name

Address



# COLGATE'S Shaving Stick

"HANDY GRIP" AND REFILL



### For Comfort, Convenience and Economy

When we say to you that the Shaving Stick has important advantages over shaving preparations in any other form, we can do so without bias, for we manufacture shaving sticks, powder and cream.

In its attractive nickel box, our

"Handy Grip" Shaving Stick is most convenient for traveling. It will not crush when packed, and it makes a wooderful lather for easy shaving.

It is not uncommon for a Colgate Shaving Stick to last more than a year in daily use.

The famous "Handy Grip", with a trial-size shaving stick in nickel box, sent for 10c. When the trial stick is goose, buy Colgate "Refills" for the price of the soap alone, 25c.

COLGATE & CO.

Dept. R. 199 Fulton St.

NEW YORK

Truth in advertising implies honesty in manufacture